BOILERS—MARINE & LAND

THOMAS W. TRAILL.

F. E. R. N.

FOURTH EDITION, REVISED & ENLARGED

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BOILERS,

MARINE AND LAND;

THEIR CONSTRUCTION AND STRENGTH.

BOILERS,

MARINE AND LAND;

THEIR CONSTRUCTION AND STRENGTH.

A HANDBOOK OF RULES, FORMULÆ, TABLES, &c.,

RELATIVE TO

MATERIAL, SCANTLINGS AND PRESSURES,
SAFETY VALVES, SPRINGS, FITTINGS AND MOUNTINGS
ETC., ETC.,

FOR THE USE OF

*ENGINEERS, SURVEYORS, DRAUGHTSMEN,
BOILER-MAKERS, AND STEAM USERS.*

BY

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FOURTH EDITION.

WITH ILLUSTRATIONS.

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PREFACE TO THE FOURTH EDITION.

The three previous editions (comprising over five thousand copies) having been so favourably received, the Author hopes that the Fourth Edition may be found of service to those who have to deal with Boilers, and be as well received as the former editions.

The Chase,
Clapham Common, S.W.,
November 1905.

PREFACE TO THE THIRD EDITION.

Alterations, additions, and many new Tables are introduced in this Edition, all of which, it is hoped, will be found useful to those who have to deal with Boilers.

The Chase,
Clapham Common, S.W.,
July 1896.

PREFACE TO THE SECOND EDITION.

In the New Issue, the subject matter dealt with in the First Edition has been considerably extended ; Tables have been added for Pressures up to 200 lbs. per square inch, so as to be abreast of the requirements of the time, and some of the Tables have been altered ; besides which new ones and other matter have been introduced, all of which have been specially prepared and computed for the Second Edition.

The same methods have been adopted as were followed in the preparation of the First Edition, so as to ensure accuracy in the alterations and extensions.

The Author offers his thanks to those who favourably received the First Edition, and hopes that the work in its extended form may be welcomed by those who found the First Edition of service, and also by those who may now use it for the first time. He can wish for the Second Edition no kindlier or more cordial reception than was accorded to the First.

The Chase,
Clapham Common, S.W.,
January 1890.

PREFACE TO THE FIRST EDITION.

A book with the title Boilers may be expected by some to be one in which the subject is treated more fully than it has been dealt with in the following pages ; but there are many reasons *why* the scope of the present work is limited—amongst others, considerations of time and space.

Nevertheless it is hoped that the book will be found of practical service "all round," and helpful, specially, in at least two essential points, viz., in settling the Scantlings for Boilers in process of construction, and in determining the Pressures for those already made. Should the work prove useful in these respects—both of vital importance as regard the safety and efficiency of Boilers—it will have achieved its object.

The Author desires gratefully to acknowledge the able assistance afforded him in the preparation of the Tables by the Computers and Re-computers, who have spared no pains to ensure accuracy in the calculations throughout.

The Chase,
Clapham Common, S.W.,
December 1888.

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INTRODUCTION.

THE Handbook now offered to Engineers and others, while dealing generally with the questions concerned in the Construction and Strength of Boilers, is yet (as stated in the Preface) more especially designed to afford ready and reliable assistance to those who have to settle the SCANTLINGS and determine the suitable WORKING PRESSURES of Boilers.

In regard to the first point, it should be noted at the outset that *thin* plate Scantlings, although included in the Tables, are not given with a view to their being adopted in making *new* Boilers. They are intended to be used, as *approximate* Scantlings only, by those who have to settle prudent Pressures for *old* Boilers. In such cases, no hard and fast rule can be laid down, and a good deal must be left to the experience and judgment of the Inspector.

The range to which *thick* plate Scantlings go up in the Tables is as high as is generally necessary for the various parts of boilers ; the Tables for Shells are not carried above 1 5/8 inch thick; but, should it be advisable in any case to use thicker plates, formulæ are given which will enable such cases to be dealt with. Tables, &c., for Furnaces made of plates as thick as 5/8 inch will be found, although we may note here in passing that when it was proposed not very many years since to use plates 1/2 inch thick, this was said to be " too risky," and it was held not advisable to exceed 7/16 inch. Again, when compound engines were fitted in almost every new vessel, and the use of Steel had become well established and High Pressures were required, even then, when it was suggested that plates 9/16 inch might be used, the proposal was not favourably received, and the use of such plates in furnaces was condemned in no measured language. Nevertheless, it can now be stated as a fact that plates 5/8 inch in thickness may be used if necessary. Several successful types of furnaces are now made which meet the requirements of the time, the thickness of the plates of which need not exceed 5/8 inch, and may *even be less*, except in a few extreme cases. However, it will be prudent for those who have to pay for boilers, &c., not to sanction a greater thickness for furnaces.

The Tables are all original, and have been specially computed for the work. The *form* in which many of them appear is (to the Author's knowledge at least) also new, and their range exceeds that of any set of Tables hitherto published. The arrangement adopted throughout, will, it is hoped, be found both simple and convenient. The scope of the work does not admit of giving all the data by which the results have been arrived at, but it is believed that these results will be found to represent the best modern practice according to the method of construction adopted.

As regards the *accuracy* of the Tables, the methods adopted in computation have been of such a nature, that the results may be used with confidence. The calculations throughout have been made by two or three independent computers, and the checking has been done by re-working, and not by merely going over the figures of the first calculation. When differences were observed in the results of any two calculators' work, the computations were re-made.

Those who prefer to calculate results independently, will find numerous simple formulæ given for the purpose throughout the work. There are many, however, who have neither the time nor the inclination to work out formulæ when they can arrive at a decision by a shorter, easier, and more rapid method, and it is for these that the Tables are chiefly intended. It may be mentioned that there are about 75,000 results given in the Tables, and in order to obtain these results in the *ordinary* way, it has been estimated that about 7,500,000 figures would be necessary. That the use of the Tables, then, will save both time and toil is self-evident. The Notes at the foot of the Tables, and those preceding each Set, will be found of service—examples being given explanatory of the method to be followed.

Among the Illustrations will be found several of Spring Safety Valves, and in the accompanying Tables and Notes the dimensions, &c., of the various parts for different pressures and sizes are given; these Illustrations, Tables, and Notes, as well as those which refer to Riveted Joints, will be of service to draughtsmen and others when preparing drawings, &c.; the Tables for Flat Surfaces, Cylindrical Boiler Shells, &c., Multipliers for *Vertical* Distances between Rivets, &c., may also be referred to, as by their use much labour and time will be saved when Scantlings have to be determined, weights got out, and plans, &c., prepared. The Tables throughout the book will be found to be "labour-saving."

In conclusion, the Author has to point out, that although the results arrived at, both by the Tables and the Formulæ given, may be used without hesitation—yet that it is often advisable, on grounds applicable to the special case, to adopt a more cautious course—*i.e.*, to settle the Scantlings for slightly *higher* pressures than those actually required, or determine the Pressures for Boilers already constructed at a few pounds *lower* than the amount arrived at by the Tables. In the interest of the boiler-owner, it will frequently be found a wise economy, "in the long run," to keep the Scantlings rather above, and the Pressures slightly below, the Standards fixed by the Tables. These Standards are, as stated above, *safe;* but it is not always true economy on the part of those who have to pay for repairs and renewals, to adopt the lightest Scantlings and the highest Pressures that *safety* will admit of.

In this, as in other cases, a little "generosity" in the use of material —if one may be allowed to use the phrase—will "pay" best in the end, by ensuring to the boiler a longer and more efficient working-life.

BOILERS,

MARINE AND LAND:

THEIR CONSTRUCTION AND STRENGTH.

MATERIAL FOR BOILERS.

DEFINITION OF TERMS.

In the following section, some of the properties of Iron and Steel, as employed in the construction of boilers, are given. It is, therefore, desirable that the meanings applied to the various terms used should be clearly understood at the outset. These terms and the meanings assigned to them may, or may not, be precisely those given by other writers, for there is no universal concord of opinion on the subject—a matter much to be regretted. These variations in terminology may have arisen from a desire to avoid the use of any term or any definition which was not accurate in a "commercial" as well as a "scientific" sense; for there can be no doubt that certain terms and definitions, although perfectly correct from a scientific standpoint, may be of little or no value to the practical engineer. However this may be, it is not intended to enter here into the merits or the demerits of terms and their meanings. All that can be attempted now is to give such definitions as shall prevent any possible confusion in the mind of the reader, and make the author's own meaning clear, when dealing with the materials used in the construction of boilers. The definitions necessary for our present purpose are, then, briefly as follows :—

Tensile strength is equivalent to the amount of force which, steadily and slowly applied in a line with the axis of the test-piece, just overcomes the cohesion of the particles, and pulls it into separate parts.

Contraction of area is the amount by which the area, at the point where the specimen has broken, is reduced below what it was before any strain or pulling force was applied.

Elongation is the amount to which the specimen stretches, between two fixed points, due to a steady and slowly applied force, which pulls and separates it into parts. Elongation is made up of two parts ; one due to the general stretch, more or less, over the length ; the other, due to contraction of area at about the point of fracture.

Shearing strength is equivalent to the force which, if steadily and slowly applied at right angles or nearly so, to the line of axis of the rivet, causes it to separate into parts, which slide over each other, the planes of the surfaces at the point of separation being at right angles, or nearly so, to the axis of the rivet.

Elastic limit is the point where the addition to the permanent set produced by each equal increment of load or force, steadily and slowly applied, ceases to be fairly uniform, and is suddenly, after this point is reached, increased in amount. It is expressed as a percentage of the tensile strength.

Tough.—The material is said to be "tough," when it can be bent first in one direction, then in the opposite, without fracturing. The greater the angles it bends through (coupled with the number of times it bends), the tougher it is.

Ductile.—The material is "ductile" when it can be extended by a pulling or tensile force, and remains extended after the force is removed. The greater the permanent extension, the more ductile the material.

Elasticity is that quality in a material by which, after being stretched or compressed by force it apparently regains its original dimensions when the force is removed.

Fatigued is a term applied to the material when it has lost in some degree its power of resistance to fracture, due to the repeated application of forces, more particularly when the forces or strains have varied considerably in amount.

Malleable is a term applied to the material when it can be extended by hammering, rolling, or otherwise, without fracturing, and remains extended. The more it can be extended without being fractured, the more malleable it is.

Weldable is a term applied to the material if it can be united when hot by hammering or pressing together the heated parts. The nearer the properties of the material *after* being welded are to what they were *before* being heated and welded, the more weldable it is.

Cold-short is a name given to the material, when it cannot be worked under the hammer or by rolling, or be bent when cold without cracking at the edges. Such a material may be worked or bent when at a great heat, but not at any temperature which is lower than about that assigned to dull red.

Hot-short is when the material cannot be easily worked under the hammer, or by rolling at a red heat at any temperature which is higher than about that assigned to a red heat, without fracturing or cracking. Such a material may be worked or bent at a less heat.

Homogeneous describes a material which is all of the same structure and nature.

A **Homogeneous** material is the best for boilers, and it should be of suitable **Tensile strength** with **Contraction of area** and **Elongation** best suited for the purpose, having an **Elastic limit** that will insure the structure being reliable; it should be **Tough** and **Ductile**, and its **Elasticity** fairly good ; and be capable of enduring strains without becoming too quickly or easily **Fatigued.** The material should be **Malleable** and in some cases **Weldable**; that which is of a decidedly **Cold-short** or **Hot-short** nature should be avoided.

If the physical properties ascertained by the results of tests made with the testing-machine, coupled with suitable bending tests, are satisfactory, and the material is not improperly treated during the progress of manipulation, while being put into the boiler, the latter, so far as the material is concerned, will generally turn out well, the plates being of moderate dimensions.

IRON BOILER PLATES.

Particulars of plates from about three-eighths of an inch to about five-eighths of an inch thick, of six qualities, which were carefully prepared and tested, and such as are used in the construction of boilers, will to some extent illustrate the various qualities of iron plates (within the limits of thickness stated) for boilers, although they may only represent a few of the qualities used.

The "special" quality is very seldom obtained, notwithstanding that it is most suitable for furnaces, combustion boxes, uptakes, and all parts subject to the impact of heat or flame.

"A" quality is such as may be used with confidence for furnaces, and when the plates are exposed to the impact of heat or flame; but even that is a better quality than can be usually obtained.

B, C, D, and E qualities were made by four different makers, and probably represent the best which the respective makers manufacture, as they were made with the view of being equal to a stipulated standard, although they may not all have actually been equal to the standard intended.

B quality need not be considered a low quality for furnaces, &c.; and indeed a much better quality is not easily procured.

C, D, and E qualities are such as are used for shells, although they should *not* be employed if exposed to the impact of heat or flame.

D quality comes within the range of common plates for shells, even when not exposed to the impact of heat or flame.

E quality is a low-class one for any purpose in a boiler.

Special Quality.

Tensile strength, with the grain, . . .	23 tons per sq. in.
,, ,, across ,, . . .	23 ,, ,,
Contraction of area, with the grain, . .	29 per cent.
,, ,, across ,, . .	19 ,,
Elongation, with the grain, ...	19 ,,
,, across ,, ...	13 ,,

A Quality.

Tensile strength, with the grain, . . .	22 tons per sq. in.
,, ,, across ,, . . .	21 ,, ,,
Contraction of area, with the grain, . .	27 per cent.
,, ,, across ,, . .	18 ,,
Elongation, with the grain, ...	18 ,,
,, across ,, ...	12 ,,

B Quality.

Tensile strength, with the grain, ...	22 tons per sq. in.
,, ,, across ,, ...	20 ,, ,,
Contraction of area, with the grain, . .	24 per cent.
,, ,, across ,, . .	12 ,,
Elongation, with the grain, ...	16 ,,
,, across ,, ...	8 ,,

C Quality.

Tensile strength, with the grain, . . .	22 tons per sq. in.
,, ,, across ,, ...	21 ,, ,,
Contraction of area, with the grain, . .	14 per cent.
,, ,, across ,, . .	8 ,,
Elongation, with the grain, ...	10 ,,
,, across ,, ...	7 ,,

D Quality.

Tensile strength, with the grain, . . .	21 tons per sq. in.
,, ,, across ,, ...	20 ,, ,,
Contraction of area, with the grain, . .	11 per cent.
,, ,, across ,, . .	10 ,,
Elongation, with the grain, ...	8 ,,
,, across ,, ...	7 ,,

E Quality.*

Tensile strength, with the grain, . . .	20 tons per sq. in.
,, ,, across ,, ...	19 ,, ,,
Contraction of area, with the grain, . .	9 per cent.
,, ,, across ,, . .	6 ,,
Elongation, with the grain, ...	8 ,,
,, across ,, ...	5 ,,

Notwithstanding the foregoing results, it is difficult to get good makers to guarantee a better quality of plates than the following:—

Tensile strength, with the grain, . . .	21 tons per sq. in.
,, ,, across ,, ...	19 ,, ,,
Contraction of area, with the grain, . .	20 per cent.
,, ,, across ,, . .	12 ,,
Elongation, with the grain, ...	16 ,,
,, across ,, ...	10 ,,

The foregoing do not refer to plates above about five-eighths of an inch thick, and include those as thin as about three-eighths of an inch.

The elongation was in all cases taken in a length of 10 inches; the test pieces were 2 inches broad, except in the case of the special quality, in which they were not quite so broad.

The appearance of the fracture of Special, A, and B qualities was

* There are one or two qualities inferior to E.

fibrous; that of the others was more or less crystalline. D quality showed about 60 per cent. fibrous and 40 per cent. crystalline. All the plates were made, as previously stated, with the knowledge that they would be tested, which may account for the results obtained.

Iron having the same brand as A quality, has been proved by carefully made tests to be inferior to C quality in tensile strength, contraction of area, and elongation. It is, therefore, not well to rely too much on brands; the only satisfactory plan is to prove the quality by testing. Brands, unfortunately, may be found to be delusory.

It is not probable that the results of any two series of tests will agree in all respects; but when a quality is stipulated for, the results of the tests should closely approximate to the standard agreed upon. Nevertheless, when the difference of the results, length-way and cross-way, is *not very* great as compared with that stipulated for, and the respective means of the results, length-way and cross-way, either as regards the tensile strength, contraction of area, and elongation, are about equal to the respective means of the quality settled upon, the material may be considered as fairly representing that required.

It is better to sacrifice a ton or so in tensile strength, than to lessen the contraction of area and elongation; and, generally, if the two latter be above that stipulated for, even if the tensile strength is rather less, the iron may be considered to be better and more to be relied upon, particularly for flanging.

Thicker plates of a different description, and such as have been more exclusively used for the shells of boilers of considerable size, are dealt with next. The higher qualities only can be accepted as those that can with any degree of propriety be employed for tube-plates, &c., although all the descriptions mentioned have been used for the shells, and even for other parts.

The lower qualities are objectionable, even for shells, and should never be used for tube-plates, or for plates to be flanged or worked. Qualities much better than the highest class specified have not been so generally used as could be desired, and steel plates have almost entirely taken their place. The particulars of these will be given further on.

Three-Quarters of an Inch Thick.

Tensile strength, with the grain, . . .	21 tons per sq. in.
,, ,, across ,, . . .	19 ,, ,,
Contraction of area, with the grain, . .	18 per cent.
,, ,, across ,, . .	10 ,,
Elongation, with the grain, ...	14 ,,
,, across ,, ...	8 ,,
Tensile strength, with the grain, . . .	21 tons per sq. in.
,, ,, across ,, . . .	19 ,, ,,
Contraction of area, with the grain, . .	9 per cent.
,, ,, across ,, . .	4 ,,
Elongation, with the grain, ...	7 ,,
,, across ,, ...	3 ,,

One Inch Thick.

Tensile strength, with the grain, ...	21 tons per sq. in.
,, ,, across ,, ...	19 ,, ,,
Contraction of area, with the grain, . .	18 per cent.
,, ,, across ,, . .	11 ,,
Elongation, with the grain, ...	16 ,,
,, across ,, ...	9 ,,
Tensile strength, with the grain, ...	21 tons per sq. in.
,, ,, across ,, ...	18 ,, ,,
Contraction of area, with the grain, . .	8 per cent.
,, ,, across ,, . .	3 ,,
Elongation, with the grain, ...	9 ,,
,, across ,, ...	3 ,,

One and One-Quarter Inch Thick.

Tensile strength, with the grain, ...	21 tons per sq. in.
,, ,, across ,, ...	20 ,, ,,
Contraction of area, with the grain, . .	11 per cent.
,, ,, across ,, . .	6 ,,
Elongation, with the grain, ...	11 ,,
,, across ,, ...	6 ,,
Tensile strength, with the grain, ...	21 tons per sq. in.
,, ,, across ,, ...	16 ,, ,,
Contraction of area, with the grain, . .	14 per cent.
,, ,, across ,, . .	4 ,,
Elongation, with the grain, ...	11 ,,
,, across ,, ...	2 ,,

The elongation was taken in every case in the standard length of 10 inches, and all the test pieces were carefully prepared to about a width of 2 inches.

Several of the higher qualities showed a considerable amount of fibre at fracture ; some off the same plates were more crystalline, while others of the same batch were so decidedly crystalline that they could not be considered fit for any part of a boiler. Moreover, the tensile strength, contraction of area, and elongation, varied considerably in some cases, even when the test pieces were cut from the same plate.

Iron plates being so different in quality, no two series of tests are *exactly* alike ; but the means of the foregoing results, thin and thick (*not* including the special quality) practically agree with the means of another series of tests that have been made. The tensile strength is rather more, and the contraction of area and elongation are slightly better ; but this may be accounted for, as all the plates in the series described above were made or supplied with the knowledge that they would be tested; whereas in the series with which they have been compared, it was *not* known that they would all be tested, and consequently, perhaps, the plates were not quite so good. Unless the higher qualities

are specified for, they are not likely when tested to be found equal to anything above medium quality, and frequently might be found to be of a quality that could not be recommended for use in boilers.

If the contraction of area and elongation can be increased by lowering the tensile strength, it may be repeated that it is better to forego a ton or so in tensile strength.

Too much reliance should not be placed on any plate, unless a piece has been cut from it, and by the results of the tests it has been found suitable for the purpose intended.

Brands may be deceptive; and if the quality is judged by the stamp upon it, too frequently the result may be disappointing.

Thick iron boiler-plates are not, as a rule, very satisfactory, particularly as to ductility; hence, steel plates, which are made more ductile and of greater tensile strength, have almost superseded them.

Iron Bar Stays.

Iron manufactured by the same makers, and having the same brand, has been found, when tested, to vary considerably as regards tensile strength, elongation, and contraction of area. The following results of carefully made tests on iron supplied by different makers represent neither the worst nor the best obtainable; and while it is *not* desirable to use a quality inferior to the lowest referred to, if the results of tests are equivalent to the highest recorded here, they may be considered to represent a fair quality, such as is frequently used in good boilers.

Tensile strength, from about 21 to about 23 tons per square inch.

Elongation, from about 18 to about 25 per cent. (or even about 30 per cent.), taken in a length of 10 inches.

Contraction of area, from about 33 to about 40 per cent.; but the contraction should be more if the ends of the stays are to be riveted.

The small bars may be expected to have the greatest tensile strength and the greatest contraction of area.

The *test* pieces of the greatest diameter, if of good quality, may be expected to have the greatest elongation.

If the small sizes are of good quality, they may be expected to be more fibrous in appearance at the point of fracture than the large sizes; the latter are frequently crystalline to the extent of about 10 to 15 per cent. In the common qualities this amount is increased. The best and finest iron should be fibrous.

Iron Rivet Bars.

Rivet bars are frequently of an indifferent quality, but the following has been found to make good rivets:—

Tensile strength, about 25 tons per square inch.

Elongation, about 25 per cent., taken in a length of 10 inches; the elongation should be rather more when the diameter of the test piece is large.

Contraction of area, about 45 per cent.

The appearance of fracture fibrous.

Iron Rivets.

Tensile strength, about 25 tons per square inch.

Contraction of area, about 45 per cent.

When in single shear, the shearing resistance may be *about* 17 tons per square inch in plate joints; but when in double shear, it is usual to take it at 1·75 times the single shear. The single shear of the rivets in some joints is not worth more than about 16 tons, in others it may be equal to about 18 tons per square inch.

The tensile strength of rivets may be higher than those of the bars from which they are made.

The rivets should be prepared in a careful and uniform manner for testing, and the length of the part turned parallel should always be 2·5 times the turned diameter.

The appearance of fracture should be fibrous.

STEEL BOILER PLATES.

The following remarks are based on the results of carefully made tests on such plates as are used in the construction of good boilers. The plates were tested in their normal condition—that is, as they left the rolls, and not after having been annealed.

The mean tensile strength is about 29 tons per square inch.

For the shells, the tensile strength should *not* exceed 32 tons per square inch (as steel is now made), and 27 tons is low enough.

For furnaces, in those exposed to the impact of heat or flame and those to be flanged or worked, the tensile strength should *not* exceed 30 tons per square inch, and should *not* be less than 26 tons, although for *special* purposes a very good quality is made having about the same tensile strength as good wrought iron plates.

For general use throughout the boiler, 28 tons per square inch is a good tensile strength, such as is suitable for furnaces, flanging, &c., and for shells.

The mean elongation, taken in a length of 10 inches, is about 25 per cent.

The elongation, taken in a length of 10 inches, seldom exceeds 30 per cent.

The elongation, taken in a length of 10 inches, should *not* be less than 20 per cent.

As the tensile strength increases, the elongation may be expected to diminish, but plates having less than 20 per cent. elongation should not be used ; about 25 per cent. elongation should be aimed at, more particularly for furnaces and flanging plates, and those exposed to the impact of heat or flame.

All plates when cold should be capable of bending to a radius of 1·5 times the thickness of the plate, and until the sides are parallel at a distance of not more than three times the thickness of the plate ; but if the plates are to be used for furnaces, or to be flanged or exposed to the impact of heat or flame, they should stand bending to the same extent after being heated to a cherry-red, and at such heat plunged into water of 80° Fahrenheit, and kept in the water until the plate and water are of the same temperature.

There is no difficulty in obtaining plates which will comply with the above conditions if the test pieces are carefully prepared, and are about 2 inches broad, or even slightly less when the plates are thick, and the elongation taken in a length of 10 inches.

All steel plates should be tested before being used for boilers, and should not be annealed before the tests are made.

Brands may be delusory.

The contraction of area is generally greatest when the plates are thick ; good thick plates may show about 48 per cent. with the grain, and thin ones about 45 per cent.

The elongation of good thick plates may be about 27 per cent., and that of thin ones 25 per cent.

Across the grain both the contraction of area and elongation may be from about 5 to 10 per cent. less than with the grain.

The elastic limit may be expected to be about the same with and across the grain. The elastic limit of thin plates may be about 60 per cent. of the ultimate strength, and that of thick ones may only be about 50 per cent.

If a plate has a high tensile strength and only a moderate amount of contraction of area and elongation, the elastic limit may be higher than if the plate were very soft.

Steel Stay Bars.

The properties of steel stay bars vary ; the following remarks refer to carefully made tests and bars within such limits as are used in good boilers :—

Tensile strength, from 27 to 32 tons per square inch.

Mean elongation, about 25 per cent. when taken in a length of 10 inches.

The elongation should not be less than 20 per cent.

The elongation seldom exceeds about 30 per cent.

The elongation should be greatest in the test pieces having the greatest diameter.

Contraction of area, from about 40 to about 50 per cent.

Steel Rivet Bars.

Mean tensile strength, about 28 tons per square inch.

The tensile strength should not be less than 26 tons per square inch.

The tensile strength should not exceed 30 tons per square inch.

The elongation should not be less than 25 per cent. when taken in a length of 10 inches, and more should be aimed at, more particularly when the diameter of the test piece is large.

The elongation seldom exceeds about 30 per cent.

The contraction of area should be as a *minimum* about 50 per cent., but about 60 per cent. should be aimed at.

All the results of the tests of the stay and rivet bars refer to tests made on bars in their normal condition—that is, not annealed ; and all such tests should be made when the material is in its normal condition.

Good steel bars are made which are no stronger than iron. Pieces from each bar should be tested for tensile strength, elongation, &c.

Steel Rivets.

The results of the tensile tests of rivets are frequently slightly higher than those obtained from the bars from which the rivets are made.

The contraction of area should be from about 50 as a minimum to about 60 per cent.

The shearing strength, if of the above quality, is usually considered as 23 tons per square inch when in single shear in riveted joints, but when the rivets are in double shear they are considered to be worth 1·75 times the single shear.

The rivets should be carefully prepared for testing; the length of the part turned parallel should always be 2·5 times the turned diameter.

STEEL FOR BOILERS.

Treatment and Peculiarities.

The general physical properties of steel such as is used for boilers having been briefly dealt with in the preceding remarks, its treatment and some of its peculiarities will now be referred to.

"Doctored" Material.

The term "doctored" is used, possibly for want of one more expressive, to describe that which takes place when mild steel boiler plates, &c., are subjected to such treatment that the results of mechanical tests are considerably different after the material has been so doctored.

It has been found that the physical properties of doctored plates differ materially from those of plates tested in their normal condition —that is, as they left the rolls—*e.g.*, plates from ¼ inch to about 1¼ inch thick, which had a tensile strength of about 27 tons to 29 tons per square inch, with an elongation of about 20 to 25 per cent. in lengths of 10 inches, when tested in their normal condition, having been laid on the mill floor to cool immediately they left the rolls, had their physical properties altered by being heated to a bright red in a furnace, and then laid on the mill floor to cool, as such treatment reduced the tensile strength from about 2 to 10 per cent.; but the elongation, when compared with the elongation of the plates in their normal condition, was found to be increased from about 12 to 22 per cent. There was, moreover, a still greater difference found when the material was heated to a bright red, and allowed to remain in the furnace to cool down, as by this method the reduction in the tensile strength varied from about 6 to 17 per cent.; and the elongation, when compared with the elongation in the normal condition, was increased, except in *some* thin plates, from about 19 to 30 per cent. Makers can and do produce a quality that is not so much affected by doctoring as stated above.

When pieces from the same plates were doctored in a different way, the results of the tests made after the treatment were found to differ still further from those made when the test pieces were in the normal condition of the plates, as it was found that heating to a bright red, and then cooling in water of about 80° F. increased the tensile strength from about 11 to 29 per cent. above the tensile strength when tested in their normal condition; but the elongation in 10 inch lengths, when compared with the elongation in the normal condition, was reduced from about 26 to 80 per cent. Again, when heated in the same way, but cooled in water at about 55° F., the tensile strength was still further increased, as it was found to be from about 15 to 42 per cent. above what it was when the pieces were tested in their normal condition; and the elongation, when compared with the elongation of the pieces tested in their normal condition, was reduced from about 50 to 83 per cent.

Testing.

Unless a piece of each plate and bar be tested, so as to ascertain the physical properties of the material, steel not only irregular and indifferent in quality, but that which is of a dangerous description, may get worked into a boiler. If the results of the tests from a portion cut from the end of a plate, which is rolled of a *moderate* size, be satisfactory, it is not as a rule necessary to have further tests made from the same plate ; but when the plate is large, there should be pieces cut and tested from each end of the plate and if very large from each corner. Bars may be rolled, say 30 or 40 feet long, &c., and generally one test piece off the bar is sufficient, although the bar may be subsequently cut into two or more lengths. All test pieces should be cut off the plates and bars in their normal condition, and the pieces should be tested in their normal condition—that is, as they leave the rolls, and not after being annealed.

Plates and Bars from the same Charge.

Plates and bars made from the same charge are frequently found to vary in ductility and tensile strength. In some cases the elongation has been found to vary several hundred per cent., and the tensile strength has been below that of ordinary iron ; and in other cases pieces have had a tensile strength much higher than is considered suitable for boiler construction ; in some instances it has been found that the pieces which had the lowest tensile strength were also the most deficient in elongation.

Plates and Bars made from Different Parts of the same Ingot.

Plates and bars made from the same ingot, but from a different part of it, have frequently been found to vary so much, that while that made from one part of the ingot was well within the usual limits as to tensile strength and elongation, &c., that rolled from another part of the same ingot was not such as could with prudence be used in any part of a boiler.

Difference due to Temperature when Rolled.

The physical properties of plates and bars have been found to differ even when made from about the same part of the ingot. This difference may possibly be attributed to the temperature at which they were rolled, although when heated to a bright red, after being rolled and allowed to cool gradually, the difference may not exist. It is always better to avoid such doctoring, and it is more prudent to use such material as comes within the prescribed suitable limits when tested in its normal condition—that is, as it leaves the rolls, and without being annealed—as it is a more certain way of getting material of uniform and suitable quality—material, in short. which has not been "doctored."

The best way to avoid questionable material is to avoid those who cannot make reliable plates without doctoring them. The majority of good makers do not doctor their material, and have *fewer* "*wasters.*"

Plates which have been Heated or Worked.

Plates which are not heated uniformly in one operation, or heated and worked, no matter *how* they may be heated, should after such treatment be *immediately and in one operation* heated to a bright red, and allowed to cool gradually. When this has not been done, plates have in many instances cracked, sometimes within an hour; in other cases hours and days, and even weeks and months, have elapsed before the plate cracked; in some cases they have cracked without being touched at the time; while in others they have cracked when struck a slight blow, the plates being of a mild description—that is, of moderate tensile strength, and having good elongation. The failures which have taken place with steel plates of good quality have in nearly all cases been traced to the treatment which they received; and in every case when the plate had been satisfactorily proved to be of good quality before it had been heated or worked, improper usage or want of proper treatment had been the cause of failure. Steel should not be worked when hot below a red heat.

Flanging.

All flanging, so far as practicable, should be done in one operation; hydraulic appliances are the most desirable, and the plate *immediately* after it has been flanged should be heated to a bright red, and allowed to cool gradually.

Bending Plates when Cold.

Plates should be bent when they are cold to the required curvature for cylindrical shells, receivers and domes, &c. Plates which will not stand bending when cold should not be used; there are rolls well adapted for such work, being capable of bending large plates, and thicker than any yet used for shells of boilers.

Welding.

Any part of a boiler which is to be subjected to a tensile stress should not be welded. Although welds in tension are very uncertain and even dangerous, they may not be so when subjected to a compressive stress, such as in the longitudinal seams of furnaces, but after being welded the whole should be efficiently annealed.

Drilling and not Punching.

Plates should not be punched, as such treatment has been found not only to impair the strength of the material, but also to make it dangerously unreliable, which is much more serious than if it only

reduced the tensile strength. With suitable drilling appliances, boilers can be constructed at less cost than by the barbarous method of punching the holes ; and no boiler works can now be considered as a first-class establishment which has not suitable appliances for drilling the holes in place. It has been proved, in several good boiler works, that the cost of construction is less when the holes are drilled by suitable machines than when they are punched. Good machines can be obtained, which will soon repay the outlay, and ultimately effect a saving of labour ; moreover, a reliable and safe boiler can be turned out, instead of one in which, when the holes are punched, no confidence can be placed, and which may explode without giving warning, through the material having been ruined by punching.

Steel Serviceable and Reliable.

Notwithstanding the peculiarities of mild steel, it is a material which may be used with safety and advantage, if proper precautions be taken and due consideration given to these peculiarities ; possibly it has fewer infirmities than iron ; and there can be no doubt that it is a better and more serviceable material for general use in the construction of boilers.

IRON BOILERS.

Cylindrical Shells.

Iron as our oldest friend has the first place in this section, although our comparatively new acquaintance, Steel, may merit equal if not more consideration.

The shells of cylindrical iron boilers, before they can be considered first-class, should be made of the highest quality of iron plates. All the seams should be at least double riveted, and fitted with double butt straps ;* all the rivet holes should be drilled after the plates are bent and bolted in place, and the holes in the butt straps should be countersunk with a *slight* taper from the outside (about three-fourths the thickness of the butt strap), and the plates afterwards taken apart and the burr removed before they are riveted up; the minimum thickness of each butt strap should never be less than five-eighths the thickness of the shell plate, but may require, both for strength and to insure a steam-tight joint, to be considerably thicker ;† the allowance for rivets in double shear should not exceed 1·75 times that for single shear.

* Shell seams *exposed* to impact of heat or flame *not* double butt straps, longitudinal seams can generally be kept free from impact of heat or flame.

† The minimum thickness of the butt straps can be ascertained, and the distance between rows of rivets should be proportioned in accordance with the formulæ applicable to the particular description of riveting, or by Tables Nos. 346 and 347, which will be found further on.

If the foregoing conditions have been complied with, and the boiler has been efficiently inspected during the whole period of construction, and it is in all other respects satisfactory, then 5 may be used as a *nominal* factor of safety in finding the "working pressure," which throughout the book means the load on the safety valves.

From what follows it will be seen that under certain circumstances additions should be made to the *nominal* factor 5, varying according to the circumstances of the case; but when the plates are thick and the holes punched, it is desirable that a higher factor than 5 be used to commence with.

If, instead of being fitted with double butt straps, and at least double riveted, the circumferential seams are lap and at least treble riveted, it need not prevent the factor 5 being used, if the circumstances of the case make it desirable to do so; but in such cases the percentage strength of the circumferential seams should be as high as practicable, with moderate pitches. Treble riveting applies principally to the middle seams, not necessarily to end seams, which should be at least double riveted.

The tensile strength of the iron may be considered as equal to 47000 pounds per square inch with the grain, and 40000 pounds across the grain. But if the foregoing conditions be not complied with, the additions in the following Table should be made to the *nominal* factor 5, according to the circumstances of each case, and the sum, 5 *plus* the appropriate additions, used as the *nominal* factor in calculating the working pressure. If lightness be *absolutely* necessary and each plate be tested, and the elongation in 10 inches be *not* less than 14 per cent. with and 8 per cent. across the grain, and the plates and rivets found to be in all respects satisfactory, then the *nominal* factor 5 may be reduced to 4·5, but the *actual lowest* tensile strength of the plates should be used in calculating the working pressure. When such a *low nominal* factor as 4·5 is used, the percentage strength of the rivets should *not* be less than that of the plates. See clause "Rivets and Plates of Equal Strength (Iron)," page 22, or use the Tables for Steel Plates and Steel Rivets, which are very suitable for Iron Plates and Iron Rivets.

The *nominal* factors are factors of safety and not of economy, and it would be to the ultimate pecuniary interest of boiler owners were they increased; except in cases where lightness is of paramount importance, the cost of the extra weight of material would be small in comparison with the ultimate saving.

Table of Additions.

Longitudinal Seams.	† A	When all the holes are fair and good in the longitudinal seams, but drilled out of place after bending, ... add But if all the holes be afterwards bored or rimered out in place, and are as fair as if they had been drilled in place, A may be omitted.	·15	A
	† B	When all the holes are fair and good in the longitudinal seams, but drilled out of place before bending, ... add But if all the holes be afterwards bored or rimered out in place, and are as fair as if they had been drilled in place, B may be ·2.	·3	B
	† C	When all the holes are fair and good in the longitudinal seams, but punched after bending, ... add But if all the holes be afterwards bored or rimered out, and are as fair as if they had been drilled in place, C may be ·2.	·3	C
	† D	When all the holes are fair and good in the longitudinal seams, but punched before bending, ... add But if all the holes be afterwards bored or rimered out in place, and are as fair as if they had been drilled in place, D may be ·4.	·5	D
	* E	When all the holes are not fair and good in the longitudinal seams, at least . . add	·75	E
Circumferential Seams.	† F	When all the holes are fair and good in the circumferential seams, but drilled out of place after bending, ... add But if all the holes be afterwards bored or rimered out in place, and are as fair as if they had been drilled in place, F may be omitted.	·1	F
	† G	When all the holes are fair and good in the circumferential seams, but drilled before bending, ... add But if all the holes be afterwards bored or rimered out in place, and are as fair as if they had been drilled in place, G may be ·1.	·15	G

Table of Additions—*continued.*

Circumferential Seams.	† H	When all the holes are fair and good in the circumferential seams, but punched after bending, ... add But if all the holes be afterwards bored or rimered out in place, and are as fair as if they had been drilled in place, H may be ·1.	·15	H
	† I	When all the holes are fair and good in the circumferential seams, but punched before bending, ... add But if all the holes be afterwards bored or rimered out in place, and are as fair as if they had been drilled in place, I may be ·15.	·2	I
	J	When all the holes are not fair and good in the circumferential seams, at least . . add	·2	J
Longitudinal Seams.	K	When double butt straps are not fitted to the longitudinal seams, and the said seams are lap and double riveted, . . . add	·2	K
	L	When double butt straps are not fitted to the longitudinal seams, and the said seams are lap and treble riveted, . . . add	·1	L
	M	When only single butt straps are fitted to the longitudinal seams, and the said seams are double riveted, ... add	·3	M
	N	When only single butt straps are fitted to the longitudinal seams, and the said seams are treble riveted, ... add	·15	N
	O	When any description of longitudinal joint is single riveted, ... add	1.	O
Circumferential Seams.	P	When the circumferential seams are fitted with single butt straps and are double riveted, add	·1	P
	Q	When the circumferential seams are fitted with single butt straps and are single riveted, add	·2	Q
	R	When the circumferential seams are fitted with double butt straps and are single riveted, add	·1	R
	S	When the circumferential seams are lap and are only double riveted, ... add	·1	S
	T	When the circumferential seams are lap and are single riveted, ... add	·2	T

Table of Additions—*continued.*

Circumferential Seams.	U When the circumferential seams are lap, and the strakes of plates are not entirely under or over, ...	add	·25	U
	V When the boiler is of such a length as to fire from both ends, or is of unusual length, such as flue boilers, and the circumferential seams are fitted as described opposite, P, R and S, ...	add	·3	V
	When the circumferential seams are as described opposite Q and T, V ·3 should become V ·4. But V may be omitted altogether if the circumferential seams be treble riveted and lap, and at least equal to 65 per cent. of the solid plate.			
	W When the seams are not properly crossed,	add	·4	W
	X When the iron is in any way doubtful, and the Engineer Inspector is not satisfied that it is of the best quality, at least . . .	add	·4	X
	§ Y When the boiler is not specially inspected during the whole period of its construction, .	add	1·65	Y

* Where marked with an asterisk, it may be advisable to increase the additions to the *nominal* factor still further, if the workmanship or material be very doubtful or very unsatisfactory; or when the iron plates are very thick, it may be advisable to add something more, particularly if the joints be lap, as is stated in the paragraphs immediately preceding the table of additions.

† When the holes are bored or rimered out in place, the case should be carefully considered, as the circumstances may warrant a reduction of the additions of A, B, C, D, F, G, H, or I, to the extent stated in the table.

§ Iron boilers that have not been *specially* inspected by the Engineer Inspector during the whole period of construction should be particularly examined, and the whole circumstances carefully considered, with the view of determining what additions should be added and the *nominal* factor that should be used; the addition Y being equal to D + E + I + J or ·5 + ·75 + ·2 + ·2 equals 1·65.

Riveted Joints of Cylindrical Shells, Receivers, Domes, &c. (Iron).

The diameter of the rivets should never be less than the thickness of the plate, and in most cases should be greater.

When the plates are thin, or when joints are lap, or when only a single butt strap is fitted, the diameter of the rivets should always exceed the thickness of the plate.

The actual shearing strength of rivets is about five-sixths the tensile strength of the plate, but in iron plate joints it is usual to assume the shearing strength of the rivets as being equal to the tensile strength of the plate, and on this assumption the percentage strength of any joint or other particulars of the joint may be found by the following formulæ :—

p = Pitch of rivets in inches.
d = Diameter of rivets in inches.
A = Area of one rivet in square inches.
n = Number of rivets in one pitch (greatest pitch).
p_D = Diagonal pitch in inches.
V = Distance between rows of rivets in inches.
$\%$ = Percentage of plate left between rivets in greatest pitch.
$\%_1$ = Percentage of rivet section as compared with solid plate.
$\%_2$ = Percentage of combined plate and rivet section when the number of rivets in the second row is twice that in the outer row.
c = 1 For lap or single butt strap joints.
c = 1·75 For double butt strap joints.
T = Thickness of plate in inches.

To find the percentage strength of any given joint—

$$\frac{100(p-d)}{p} = \% \quad . \quad . \quad . \quad (1)$$

$$\frac{100 \times A \times n \times c}{p \times T} = \%_1 \quad . \quad . \quad . \quad (2)$$

When the number of rivets in the second row is twice that in the outer row—

$$\frac{100(p-2d)}{p} + \frac{\%_1}{n} = \%_2 \quad . \quad . \quad . \quad (3)$$

The lowest of the values so found is the percentage strength of the joint.

The formula (3) is given, although its use will seldom be found necessary. In double butt strapped joints $\%$ or $\%_1$ is always less than $\%_2$ so long as the diameter of the rivet is not less than the thickness of the plate, and in lap joints when the diameter is not less than $\frac{T}{\cdot 7854}$.

To find d when p, n, c, T are known so that % may be equal to $\%_1$—

$$\sqrt{\frac{T}{1{\cdot}57 \times n \times c}\left\{\frac{T}{1{\cdot}57 \times n \times c} + 2p\right\}} - \frac{T}{1{\cdot}57 \times n \times c} = d \qquad (4)$$

To find p when d, n, c, T are known so that % may be equal to $\%_1$—

$$\frac{A \times n \times c}{T} + d = p \quad . \quad . \quad . \quad (5)$$

To find d and p when n, c, T and the required percentages are known—

$$\frac{\% \times T}{(100 - \%) \times {\cdot}7854 \times n \times c} = d \quad . \quad . \quad (6)$$

$$\frac{100 \times \% \times T}{(100 - \%)^2 \times {\cdot}7854 \times n \times c} = p \quad . \quad . \quad (7)$$

Rivets and Plate of Equal Strength (Iron).

If it be desired to construct the joints so that the shearing strength of the rivets may be equal to the tensile strength of the plates, equation (2) and the first term of equation (5) should be multiplied by $^5/_6$, and equation (6) and (7) by 1·2; 1·309 should be substituted for 1·57 in equation (4), and equation (3) becomes applicable to lap joints when the diameter of the rivets is less than $\frac{T}{{\cdot}6545}$.

Diagonal Pitches (Iron).

In any case the diagonal pitch, p_D, between the outside and the next row of rivets should not be less than is found by the following formula:—

(1) Ordinary zigzag riveting, and chain riveting when each alternate rivet is omitted in the outside row—

$$\cdot 6p + \cdot 4d = p_D.$$

$$\frac{\sqrt{(11p + 4d)(p + 4d)}}{10} = V.$$

But V should not be less than $\frac{4d+1}{2}$ in chain riveted joints.

(2) Zig-zag riveting, when each alternate rivet is omitted in the outside row—

$$\cdot 3p + d = p_D.$$

$$\frac{\sqrt{(11p + 20d)(p + 20d)}}{20} = V.$$

The value of the metal in the diagonal pitch is only about five-sixths of what it is in the horizontal pitch; therefore the net section in the diagonal pitch should be one-fifth greater than it is in the horizontal pitch, or in the part of the horizontal pitch to which it is required to be equivalent in strength.

Iron Butt Straps.

Butt straps should always be cut from plates, and not from bars; they should be of as good a quality as the shell plates, and for the longitudinal seams should be cut across the fibre.

When the plates are drilled in place, the butt straps should also be drilled in place, and after drilling they should always be taken apart, the burr taken off, and the holes in the straps countersunk with a slight taper from the outside.

Double Butt Straps (Iron).

When double butt straps are fitted, each butt strap should not be less than five-eighths of the thickness of the shell plate, but it may be necessary to have them thicker. With wide pitches an efficient and tight joint cannot be made unless the butt straps are sufficiently thick, and the thickness of each in such cases should considerably exceed five-eighths of the thickness of the shell plate.

When the pitch is not the same in each row, or the rivets in each row are not the same size, the thickness of the butt straps requires to be increased to obtain the strength as well as to enable a tight joint to be made.

The minimum thickness of butt straps is found from the following formulæ:—

Thickness of Butt Straps (Iron).

p = Pitch of rivets in outside row of rivets.
d = Diameter of rivets in inches.
T = Thickness of plate in inches.
T_1 = Thickness of each butt strap in inches (minimum).

When the pitch of rivets is the same in each row—

$$\frac{5 \times T}{8} = T_1 \quad \text{Double butt straps.}$$

$$\frac{9 \times T}{8} = T_1 \quad \text{Single butt straps.}$$

When the pitch of rivets in the outside row is double that in the row next the butt of plates—

$$\frac{5(p-d) \times T}{8(p-2d)} = T_1 \quad \text{Double butt straps.}$$

$$\frac{9}{8}\left(\frac{p-d}{p-2d}\right) \times T = T_1 \quad \text{Single butt straps.}$$

Pressures, &c., on Cylindrical Shell, &c. (Iron).

Unless the iron plates be proved to possess superior qualities, as to elongation and contraction of area, and with such ductile properties to

have a tensile strength exceeding 21 tons per square inch, they should not be assumed to have a greater tensile strength than 47000 lbs. per square inch. The smallest of the percentages as found by the preceding formulæ (1) (2) or (3) should be used as the percentage strength of the joint, and the *nominal* factor of safety should not be less than that found from the preceding table and the paragraphs immediately preceding it (*see* pages 17, 18, 19, and 20).

The working pressure should not exceed that found by the following formula:—

T = Thickness of plate in inches.
D = Inside diameter of boiler in inches.
F = Factor of safety.
r = Lowest of the percentages $\%$ $\%_1$ $\%_2$ divided by 100.
B = Working pressure per square inch in lbs.

$$\frac{47000 \times r \times 2T}{D \times F} = B$$

$$\frac{B \times D \times F}{47000 \times 2 \times r} = T$$

$$\frac{47000 \times r \times 2T}{B \times F} = D$$

$$\frac{47000 \times r \times 2T}{D \times B} = F$$

$$\frac{B \times D \times F}{2T \times 47000} = r.$$

Iron boiler plates which are to be subjected to flame or to the impact of heat should be of suitable quality, and those equal to what follows may be considered so: tensile strength with the grain about 21 or 22 tons per square inch, contraction of area about 20 per cent. and elongation about 16 per cent.; across the grain, tensile strength about 19 tons per square inch, contraction of area about 12 per cent. and elongation 10 per cent., when the specimens are tested in strips 2 inches wide and the elongation taken in a length of 10 inches. The plates for furnaces, combustion boxes, and all parts exposed to the direct impact of flame and heat should not be of a low quality.

Iron plates may be considered suitable for the shells of boilers, if not exposed to flame and the direct impact of heat, and if not to be flanged, if they have a tensile strength with the grain of about 21 or 22 tons and across the grain of about 18 tons per square inch, with a contraction of area and elongation slightly less than that for furnace plates; but when the plates are about three-quarters of an inch thick and upwards, they are not generally quite so good. In another part will be found some remarks as to iron boiler plates (*see* p. 4 *et seq.*), from which it will be seen that better qualities of plates can be made, but better qualities than those given above are seldom guaranteed by really good makers except at a very high price.

Curved Ends of Cylindrical Iron Boilers.

When the ends of cylindrical boilers are curved to join the shell, the working pressure should not exceed that found by the following formula :—

R = Radius of curved end in inches.
d = Diameter of tubes outside in inches.
T = Thickness of tube plate in inches.
p = Pitch of tubes in inches horizontally.
% = Percentage of iron left between each tube as compared with the solid plate of a length equal to p.
C = 9500 when the stress is with the grain of the iron.
C = 8000 when the stress is across the grain of the iron.
B = Boiler pressure per square inch in lbs.
r = Percentage of plate section (%) divided by 100.

$$\frac{100(p-d)}{p} = \%$$

$$\frac{100d}{100-\%} = p$$

$$\frac{C \times r \times T}{R} = B \dagger *$$

$$\frac{R \times B}{C \times r} = T *$$

As all the tube plates are more or less injured by expanding or drifting the tubes, the above constants should be considered as maximum ones, and when the iron is not of very good quality, both as regards tensile strength and ductility, the constants should be reduced from 9500 to about 7500, and from 8000 to about 6500.

Cylindrical Superheaters (Iron).

The strength of the joints of cylindrical superheaters and the factor of safety should, when made of the best quality of iron plates, be found in a similar manner as for cylindrical boilers and steam receivers, but instead of using 47000 lbs. as the tensile strength of iron, 30000 lbs. should be used ; where the heat or flame impinges at or nearly at right angles to the plate, 22400 lbs. should be substituted.

When a superheater is constructed with a tube subject to an external or collapsing pressure, the working pressure should be ascertained in the same way as the working pressure for circular furnaces, but the

* If the percentage strength of the horizontal riveted seam above the tubes be less than the percentage of plate left between the tubes, it should be used in the above formula for calculating the working pressure, &c.

† If the thickness of the curved plate be less than that of the tube plate, the percentage left in each should be multiplied by its respective thickness, and the lesser of the two values used in place of $r \times T$, as given in the formula.

constants should be reduced at least 36 per cent., and if much flame passes through the tube it may be necessary to reduce the constants a great deal more, as the iron plate when hot may be less than about one-fifth of the strength of the cold plate.

When superheaters are constructed so that they cannot be entered on account of their size, &c., they should have a sufficient number of openings through which a thorough inspection of the whole of the interior can be made, and the doors for these openings should be made and secured in the same way as manhole and mudhole doors, and the openings stiffened and strengthened in like manner.

When a superheater can be shut off from the main boiler or boilers it should be fitted with a safety valve of sufficient size, and so constructed that the pressure on it cannot be increased when steam is up.

The least size of safety valve on a superheater, unless there be some very good reason to the contrary, should be 3 inches diameter.

Drain pipes should in all cases be fitted to each superheater in which a collection of water in the bottom is possible ; a drain pipe is also desirable to allow of any mud being washed away.

Circular Iron Furnaces.

The working pressure on plain circular furnaces, when they are *horizontal*, and made of wrought iron plates of the best quality, should not exceed that found by the use of the constants and formula which follow, provided the pressure so found does not exceed that arrived at by the use of the formula $\frac{9000 \times T}{D}$

D = Outside diameter of furnace in inches.
*L = Length of furnace in feet.
T = Thickness of plate in inches.
B = Working pressure per square inch in pounds, which should not exceed that found by the formula $\frac{9000 \times T}{D} = B.$
C = Constant according to the circumstances of the case, the values of which are as follows :—

Furnaces with Welded Seams or Butt Joints and Drilled Rivet Holes.

When the longitudinal seams are welded, . . . C = 90000

When the longitudinal seams are double riveted and fitted with single butt straps, ... C = 90000

When the longitudinal seams are single riveted and fitted with single butt straps, ... C = 80000

When the longitudinal seams are single riveted and fitted with double butt straps, ... C = 90000

* The length should be measured between the rings, Bowling hoops, &c., if so fitted.

Furnaces with Butt Joints and Punched Rivet Holes.

When the longitudinal seams are double riveted and fitted with single butt straps, ... $C=85000$

When the longitudinal seams are single riveted and fitted with single butt straps, ... $C=75000$

When the longitudinal seams are single riveted and fitted with double butt straps, ... $C=85000$

Furnaces with Lapped Joints and Drilled Rivet Holes.

When the longitudinal seams are double riveted and bevelled, ... $C=80000$

When the longitudinal seams are double riveted and not bevelled, ... $C=75000$

When the longitudinal seams are single riveted and bevelled, ... $C=70000$

When the longitudinal seams are single riveted and not bevelled, ... $C=65000$

Furnaces with Lapped Joints and Punched Rivet Holes.

When the longitudinal seams are double riveted and bevelled, ... $C=75000$

When the longitudinal seams are double riveted and not bevelled, ... $C=70000$

When the longitudinal seams are single riveted and bevelled, ... $C=65000$

When the longitudinal seams are single riveted and not bevelled, ... $C=60000$

The following formula for the working pressure is intended for furnaces up to about 10 feet long and of ordinary diameters, and when the length exceeds that, it is advisable in all cases to fit strengthening rings or hoops, &c. :—

$$\frac{C \times T^2}{(L+1) \times D} = B\,*$$

$$\frac{C \times T^2}{(L+1) \times B} = D$$

$$\sqrt{\frac{(L+1) \times D \times B}{C}} = T$$

$$\frac{C \times T^2}{D \times B} - 1 = L$$

$$\frac{(L+1) \times D \times B}{T^2} = C.$$

* The working pressure should not exceed that found by the limiting formula $\left(\frac{9000 \times T}{D}\right)$. The pressures arrived at by the use of the Tables Nos. 65 to 77, also Nos. 271 to 283 may be used. When the furnaces are made with flanged joints, Table No. 78 may be used, or Table No. 284, or the formulæ page 530.

Vertical Furnaces or Fire Boxes (Iron).

In the case of upright fire boxes of donkey or similar boilers, 10 per cent. should be deducted from the constants applicable to the respective classes of work, description of seam or joint; but a greater reduction should be made if the diameter does not decrease at least one inch per foot of height.

Curved Tops of Combustion Boxes (Iron).

The curved tops of combustion boxes, on account of the want of continuity, are not capable of withstanding nearly the same pressure as a complete cylinder of the same radius, and should be stiffened by T bars. The constants for plain cylindrical furnaces, when applied to the top of combustion boxes, should be considerably reduced; the tops of combustion boxes have been known to come down at about half the pressure suitable for a round furnace having the same thickness of plate and radius.

The curved tops of combustion boxes should be efficiently stayed to the end of the boiler; and when there are double combustion boxes, back to back, they should be efficiently tied together. The length of the box in inches, multiplied by the radius of curvature in inches, is the least surface in square inches for which stay power is required; but it may be necessary to provide more stay power if the longitudinal stays are not sufficient to support the end plates to about the level of the top of the combustion boxes.

It is desirable that the radius of curvature be not less than the width of the box, in order to avoid, as far as practicable, any flat surface on the top corner next the tube plate.

The plates should be of a very good quality.

Corrugated Iron Furnaces.

The working pressure for corrugated furnaces made of the highest quality of iron plate, provided they are practically circular, and machine-made, and the plain parts at the ends do not exceed 6 inches in length, and the plates not less than $5/16$ inch thick, when new, should not be greater than found by the following formula, where

T = Thickness of plate in inches.

D = Mean diameter in inches.

C = 9000.

B = Working pressure per square inch in lbs.

$$\frac{C \times T}{D} = B$$

$$\frac{C \times T}{B} = D$$

$$\frac{B \times D}{C} = T$$

When a furnace is riveted in two or more lengths, the case should be well considered, as it may not be prudent to allow the same pressure as when there is no circumferential seam.

Iron corrugated furnaces should be made of plates of the highest quality, and free from laminations, otherwise they will probably very soon become defective, and necessitate portions being cut out and patches put on; it is therefore most desirable, when iron is used, that every plate be tested and also carefully examined, both before and after it is corrugated. If this be not particularly attended to, trouble is sure to ensue, and great expense will be caused by renewing the furnaces. See Tables Nos. 79, 80, and 285.

Flat Surfaces (Iron).

The pressure on wrought iron plates forming flat surfaces should not exceed that found by the following formula, but when the surface is small, such as is the case in launch boilers and several descriptions of land boilers, the pressure found in the Tables in another part is that which should be used. The pressure in all cases may be taken from the Tables Nos. 2 to 30, flat surfaces, iron plates, but when the pitch is about 6 inches or under the pressure should always be taken from the Tables, and not arrived at by the formula. If the pressure is above 160 lbs., see Tables No. 225 to 253.

t = Thickness of the plate in sixteenths of an inch.
S = Surface supported in square inches.
B = Working pressure in pounds per square inch.
C = Constant according to the following circumstances:—

		Constants.
C = 160.	When the plates are not exposed to the impact of heat or flame, and the stays are fitted with nuts and with doubling strips not less in width than two-thirds the pitch of the stays, and not less in thickness than the plates they cover, and are riveted to the plates, ...	160
C = 150.	When the plates are not exposed to the impact of heat or flame, and the stays are fitted with nuts and with washers of not less diameter than two-thirds the pitch of the stays, and not less in thickness than the plates they cover, and are riveted to the plates, ...	150
C = 100.	When the plates are not exposed to the impact of heat or flame, and the stays are fitted with nuts and with washers, the latter being at least three times the diameter of the stay and two-thirds the thickness of the plates they cover, .	100
C = 90.	When the plates are not exposed to the impact of heat or flame, and the stays are fitted with nuts only, ...	90

		Constants
C = 60.	When the plates are exposed to the impact of heat or flame, and steam is in contact with the plates, and the stays fitted with nuts and washers, the latter being at least three times the diameter of the stay and two-thirds the thickness of the plate they cover, . . .	60
C = 54.	When the plates are exposed to the impact of heat or flame, and steam is in contact with the plates, and the stays are fitted with nuts only,	54
C = 80.	When the plates are exposed to the impact of heat or flame, with water in contact with the plates, and the stays screwed into the plate and fitted with nuts, ...	80
C = 60.	When the plates are exposed to the impact of heat or flame, with water in contact with the plates, and the stays screwed into the plates having the ends riveted over to form substantial heads, ...	60*
C = 36.	When the plates are exposed to the impact of heat or flame, and steam is in contact with the plates, with the stays screwed into the plates, and having the ends riveted over to form substantial heads, ...	36

When doubling plates of not less thickness than the plates they cover are riveted on outside, and cover the plates, the pressure found by the use of the constant 160 may be increased by about 25 per cent., but such a method of construction is not considered the best; and whenever doubling plates are fitted to cover the whole of the flat surface, the circumstances of the case should be *specially* considered.

The values of the letters in the following formulæ will be found immediately preceding the table of constants:—

$$\frac{C \times (t+1)^2}{S-6} = B$$

$$\frac{B \times (S-6)}{(t+1)^2} = C$$

$$\frac{C \times (t+1)^2}{B} + 6 = S$$

$$\sqrt{\frac{B \times (S-6)}{C}} - 1 = t.$$

When the stays are screwed into the plates and the ends riveted, the Engineer Inspector should see that the stays are a good fit; for if they

* When there is neither flame nor heat impinging on the plates, and water is in contact with the plates on one side, such as the outside shell or ends of the boiler, the pressure found by the constant 60 may be increased about 12 per cent., if after *specially* considering the case it is thought advisable to do so.

are not, the pressure, as found by the formula and appropriate constant, or by the tables which are in another part, should be reduced; the amount of such reduction should be settled according to the circumstances of the case.

When the ends of riveted stays are worn, or any of the nuts are burnt, the Engineer Inspector should be particularly careful as to the pressure he allows the boiler to be worked at, since it may be necessary to reduce the constant 60 by one half or even more, so as to insure that the pressure is not too great; but in all such cases, if it be possible, new stays and nuts should be fitted rather than work, even for a short time, at a reduced pressure; neglect of such easily remedied imperfections has frequently resulted in disastrous explosions.

If a plate be cracked at the hole for the stay, the piece should be cut out and a washer or plate riveted on and caulked, the stay should be renewed by a larger one, and screwed into the washer, and the ends riveted or nuts fitted; the latter is far the better way. If nuts are properly fitted, and proper fire bars used, those in the furnaces will not as a rule get burned off unless through carelessness or want of attention. This more particularly applies to marine boilers with natural draught, and not to boilers in which forced draught is used.

When stays are screwed into the plates, the tap used should be long enough to tap both plates.

The iron of which screwed stays are made should be of a particularly fine and ductile quality, more particularly when the ends are to be riveted, otherwise the riveted heads will be of little or no use, and the threads will probably be so damaged as to greatly impair the efficiency of the stay. Cold-short iron should not be used.

The plates forming flat surfaces are sometimes stiffened with T or L bars, but such a method of construction has many disadvantages and few advantages, except when used round manhole or mudhole openings; however, if they be used, little allowance should be made for them, and then only after specially considering the case.

Direct Iron Stays for Flat Surfaces.

There should not be a greater stress on solid wrought iron screwed stays which support the flat surfaces of boilers, than 7000 lbs. per square inch of net section, but the stress should not exceed 5000 lbs. when the stays have been welded or worked in the fire. Stays which have the ends "jumped on" are not reliable, and should never be used; palm ended stays are objectionable; welded stays are not desirable. It is advisable, even when solid wrought iron screwed stays are used, not to have a greater stress on them, when new, than about 5000 lbs. per square inch, and about 4000 lbs. on welded or worked stays; the extra cost, at first, will ultimately be more than saved to those who have to pay for renewals and repairs of boilers.

The size of stay, &c., may be found by the following formulæ or from the Tables Nos. 31 to 40 and Nos. 254 to 259.

A = Surface to be supported in square inches.
S = Stress on stays per square inch of net section in lbs.
B = Pressure (working) per square inch in lbs.
a = Area of stay in square inches.
d = Diameter of stay at bottom of thread in inches.

$$\frac{A \times B}{S} = a$$

$$\sqrt{\frac{a}{\cdot 7854}} = d$$

$$\frac{S \times a}{B} = A$$

$$\frac{A \times B}{a} = S$$

$$\frac{S \times a}{A} = B$$

When a stay is attached by bolts or rivets, the aggregate area of the bolts or rivets should exceed the area of the stay.

When a stay is attached by bolts or rivets, and they are subjected to a single shearing stress, their area should be about 20 per cent. more than the stay; but if subjected to double shear, their area may be about 25 per cent. less than the stay; if the stay be welded, the 20 per cent. may be reduced to 10 per cent. and the 25 per cent. increased to 30 per cent.

Direct Stays attached to Wrought Iron Cross Bars or Beams.

When a direct stay is attached to the centre of a wrought iron cross bar or beam, and the cross bar or beam is attached by two smaller stays to the plate, the aggregate area of the small stays should be about 25 per cent. more than the area of the main direct stay.

The working pressure, breadth, depth and length of the wrought iron cross bar or beam can be found by the following formula :—

B = Working pressure per square inch in pounds.
b = Breadth of beam in inches *minus* the diameter of the hole in inches for main stay.
*D = Depth of beam in inches.
L = Length of beam from centre to centre of small stays in feet.
S = Surface in square inches to be supported.
C = 500.

* The total breadth of such cross bars or beams is generally considerably in excess of their depth.

$$\frac{C \times D^2 \times b}{S \times L} = B$$

$$\frac{C \times D^2 \times b}{L \times B} = S$$

$$\frac{C \times D^2 \times b}{S \times B} = L$$

$$\sqrt{\frac{B \times S \times L}{C \times b}} = D$$

$$\frac{B \times S \times L}{C \times D^2} = b.$$

All the holes in the cross bar should be carefully drilled, so that they are made all true with the faces of the cross bar, and so that all the nuts on each face will bed properly. The end holes should be exactly equidistant from the centre of centre hole ; care should also be taken that the small stays are fitted in so that they are parallel. If this be not attended to, undue stress will be put upon them when there is a strain on the main stay ; it is also essential to have each set of small stays exactly opposite each other, for if not, they will be unduly strained when a stress comes on the main stay.

Diagonal Iron Stays.

The area of diagonal stays should not be less than that found in the following manner :—

First find the area of a direct stay needed to support the surface, then multiply this area by the length of the diagonal stay, and divide the product by the length of a line drawn at a right angle from the surface to be supported to the end of the diagonal stay ; the quotient will be the area at the smallest part of the diagonal stay required, or it may be found by the following formulæ :—

a = Area required for a direct stay in square inches.
H = Length of diagonal stay in inches.*
L = Length of line drawn at a right angle from the surface to be supported to the end of the diagonal stay in inches.
a_1 = Area of diagonal stay in square inches.
d = Diameter of diagonal stay in inches.
A = Surface to be supported in square inches.
S = Working stress per square inch on stay in lbs.
B = Working pressure in lbs.

* Although H and L are given in inches, feet may be used if both H and L are used in terms of feet.

$$\frac{a \times H}{L} = a_1$$

$$\frac{a_1 \times L}{a} = H$$

$$\sqrt{\frac{a_1}{\cdot 7854}} = d$$

$$\text{or } \sqrt{\frac{a \times H}{\cdot 7854 \times L}} = d$$

$$\text{or } \sqrt{\frac{A \times B \times H}{\cdot 7854 S \times L}} = d.$$

$$\frac{\cdot 7854 \times d^2 \times S \times L}{A \times H} = B.$$

When the palm end of a diagonal stay is attached to the shell, the area of the rivets or bolts, subjected to single shear, should have an aggregate area of about 20 per cent. greater than the stay ; if, however, the end is so made as to be attached between two angle bars, the bolt or pin may have an area of about 25 per cent. less than the diagonal stay, but the area of the rivets attaching the angle bars to the shell should be about 20 per cent. greater than the area of the diagonal stay.

It is desirable that all diagonal stays be forged and worked out of the solid ; but when this is not done, and they are welded or if the holes in the palms or ends are punched or drifted, instead of being drilled so as to entitle them to be considered as first class, the additional rivet area, as stated in the foregoing, may be 10 per cent. instead of 20 per cent. ; and the reduction of area, when the bolts, pins, &c., are in double shear, may be about 30 per cent. instead of 25 per cent. Punching the holes is very objectionable.

Diagonal stays are not recommended except when direct stays cannot be fitted ; when they are used they should be well made, properly fitted, and specially looked after by the Engineer Inspector.

The ends of diagonal stays should not be bent, and bevelled washers should be fitted under the nuts inside and outside the boiler.

The palm ends of diagonal stays should be forged out of the solid, and the holes in the palm should be drilled, and either the shell drilled when the stay is in place, or the shell may be drilled first and the stay drilled in place.

Ends "jumped on" are not only objectionable, but dangerous.

The length of diagonal stays should be as great as practicable.

The most desirable and efficient method of fitting diagonal stays, when it is necessary that they should be used, is to have a palm on one end riveted to the shell, and the other end screwed and having nuts inside and outside the boiler, with properly fitted bevelled washers under the nuts.

Stays in General (Direct and Diagonal).

The stays should be well fitted, and each one carefully tightened, and, as far as possible, every stay in a group should have the same normal strain on it. If care be not taken in fitting and tightening up stays they are liable to give way, and with them the plates to which they are attached, owing to too much strain coming on one stay.

When diagonal stays are fitted it is particularly necessary to see that the bolts or rivets by which they are secured are made to fit properly, so that each has only its fair amount of strain. Stays should not be reduced in the body. When a strain comes on those which are so reduced they stretch more than stays which are of the same diameter all over as at the top of the threads of the screwed parts, and such stretching is very injurious to the boiler; moreover, stays in almost every case corrode in the body, and not at the screwed ends. Besides, not being as efficient, such stays require renewing much sooner, which is expensive, the original cost for properly proportioned stays being much the same, and the increased weight very little.

Gusset Iron Stays.

When gusset stays are used, their area should be considerably in excess of that required for diagonal stays.

When a gusset stay is attached between double angle bars (which they should always be in preference to a single angle bar) the aggregate area of the rivets attaching the angle bars to the shell should be about 20 per cent. greater than that required for a diagonal stay, and the aggregate area of the rivets which attach a gusset to a single angle bar should also be about 20 per cent. greater than that required for a diagonal stay; but the area of the rivets when the gusset stay is attached between two angle bars, the rivets being in double shear, may be about 25 per cent. less than the area required for a diagonal stay.

Gusset stays have many disadvantages, and only one advantage as compared with direct stays; but as a diagonal stay can be used in most cases where a gusset stay can, it should be used in preference; but solid screwed direct stays should be fitted wherever it is practicable, as they are by far the best and most reliable.

When, however, gusset stays are used they should be fitted properly; the holes in them and in the angle bars rimered out when in place and the rivets should fit well; care should be taken that the angle bars are placed at the proper distance apart, so that the gusset plate is a good fit between the sides of the angle bars.

A good quality of plate should always be used, and the holes should not be punched but drilled for the rivets; the edges of the plate should have a sufficient quantity planed off so as to insure that the injury caused by shearing is removed.

Girders for Flat Surfaces (Iron).

When the tops of combustion boxes or other parts of a boiler are supported by wrought iron plates or solid wrought iron rectangular girders; provided that the girders are not subjected to a greater temperature than the ordinary heat of steam, and, in the case of combustion chambers, that the ends are properly fitted to the edges of the tube plate, and the back plate of the combustion box, or to the tube plates when the boiler is fired from each end, and the combustion box is in the middle; the working pressure should not exceed that found by the following formula (or by Table No. 41 *et seq.*, above 160 lbs. No. 260 *et seq.*) :—

W = Width of combustion box in inches.
P = Pitch of supporting bolts in inches.
D = Distance between the girders from centre to centre in inches.
L = Length of girder in feet.
d = Depth of girder in inches.
T = Thickness of girder in inches.
B = Working pressure per square inch in lbs.
C = 500 when the girder is fitted with one supporting bolt.
C = 750 when the girder is fitted with two or three supporting bolts.
C = 850 when the girder is fitted with four supporting bolts.

$$\frac{C \times d^2 \times T}{(W - P)D \times L} = B$$

$$\sqrt{\frac{(W - P)D \times L \times B}{T \times C}} = d$$

$$\frac{(W - P)D \times L \times B}{d^2 \times C} = T$$

$$\frac{d^2 \times T \times C}{(W - P)L \times B} = D$$

$$\frac{d^2 \times T \times C}{D \times L \times B} + P = W$$

$$W - \frac{d^2 \times T \times C}{D \times L \times B} = P$$

$$\frac{d^2 \times T \times C}{(W - P)D \times B} = L.$$

The working pressure for the supporting bolts and for the plate between them should not exceed that found by the formulæ for direct stays and flat surfaces, or by the Tables Nos. 31 to 40 and 2 to 30; above 160 lbs. 254 *et seq.* and 225 *et seq.* When the pitch is about 6 inches or under use the Tables for Flat Surfaces, not the formulæ.

Compressive Stress on Iron Tube Plates.

The working pressure on iron tube plates should not exceed that found by the following formula:—

D = Least horizontal distance between the centres of tubes in inches.
d = Inside diameter of the ordinary tubes in inches.
T = Thickness of the tube plate in inches.
W = Extreme width of combustion box in inches, from the front of tube plate to back of fire box, or the distance between the combustion box tube plates when the boiler is double ended and the box common to the furnaces at both ends.
C = 15000.
B = Working pressure per square inch in lbs.

$$\frac{(D-d)T\times C}{W\times D} = B$$

$$\frac{B\times W\times D}{(D-d)\times C} = T$$

$$\frac{(D-d)T\times C}{B\times D} = W$$

$$\frac{C\times d\times T}{CT-BW} = D$$

$$\frac{D(CT-BW)}{CT} = d.$$

If the iron for tube plates be not of good quality they are very liable to crack, more particularly the tube plate in the combustion chamber, and the tube plate opposite the furnace when the tubes directly face it. Scale and dirt being particularly liable to accumulate on the plate around the end of the tubes, it is therefore more liable to be affected by the intense heat to which the plate is subjected. The plate, after the tubes are expanded or drifted, has a considerable amount of strain on it, and therefore should be of a very ductile and homogeneous quality.

Uptakes (Iron).

The strength of iron uptakes of vertical boilers and others of this type, should be considerably in excess of that required for ordinary superheaters, subject to external pressure.

Bowling rings or flanged joints add to the strength and allow for expansion; T or L hoops riveted round, although not so desirable, may be employed to increase the resistance of the tubes against collapse. The use of Bowling rings or flanged joints with a moderate thickness of plate is very much better than very thick plating.

When flaming coal is used, great care is required and extra strength absolutely necessary in the uptakes; the tensile strength of the iron

plates when heated to the degree which they sometimes are, is frequently only about 9000 lbs. per square inch, or less than about one-fifth of what it is when cold.

Hemispherical Ends (Iron).

Hemispherical ends made of wrought iron plates, when subjected to internal pressure, should not have a pressure exceeding double the pressure that is suitable for a cylinder of the same diameter and thickness. The working pressure is found by the formula :—

$$\frac{4T \times 40000 \times r}{D \times F} = B.$$

D being equal to the diameter, F to the suitable factor of safety, T to the thickness of the plate in inches, % to the calculated percentage strength of joint, r to the percentage divided by 100, and 40000 the tensile strength per square inch in lbs. of the iron plate, B equalling the working pressure. Generally it is advisable to make the ends of the same thickness as the cylindrical part.

$$\frac{B \times D \times F}{4 \times 40000 \times r} = T$$

$$\frac{40000 \times r \times 4T}{B \times D} = F$$

$$\frac{D \times F \times B}{4 \times T \times 40000} = r.$$

Dished Ends (Iron).

Dished ends should be stayed. If they be theoretically equal to the pressure needed, when considered as portions of spheres; the iron stays, when solid, not welded or worked in the fire, should not have a stress on them exceeding 14000 lbs. per square inch of net section, but the stress should not exceed 10000 lbs. when the stays have been welded or worked in the fire. If they are not theoretically equal to the pressure needed, they should be stayed the same as flat surfaces.

Welded Seams (Iron).

Welding seams in the shells, receivers or domes of iron boilers is not the most reliable method of construction, there being at the best a certain amount of uncertainty about such seams, as they have been known to give out when least expected. They are not worth more than from about 60 to 70 per cent. of the solid plate, and may be worth much less. The plate near the weld is injured, due to excessive heating, &c., during the process of welding, and has been proved to be very brittle, and has broken even at less than one-fourth of what it was considered

to be worth. 9000 lbs. per square inch is a low strength for the shell plate of a cylindrical boiler, and welded seams have given way at that stress. Heating the plate, &c., as is done when welding, causes portions of it to be in tension, and portions in compression, and the stresses set up are such as to cause it to fracture at a low tensile stress, or when vibration takes place. Although these great drawbacks as to welded iron seams exist, and welding is not recommended, cases may *occasionally* arise when an Engineer Inspector may not always feel justified in refusing to accept them, but in no case should more than from about 60 to 70 per cent. as a maximum of the strength of the solid plate be allowed, as that is the utmost value when the iron is very good, and the workmanship and method of welding the best that they can be.

When seams are welded, if the whole plate were heated and allowed to cool gradually, it would remove *some* of the evil, but that is not practicable with large shells, yet the joint and about 12 inches on each side may be heated and allowed to cool gradually. In smaller cylindrical articles, such as domes, they should when welded always be heated carefully all over and allowed to cool gradually; although this may not be so necessary in the case of furnaces, as they have to bear a compressive strain, yet it is desirable that the injurious effects of welding should be removed as much as possible by annealing.

STEEL BOILERS.

There being many descriptions or qualities of steel, before it is used in the construction of boilers, it is essential that the general quality of the particular steel to be used should have been proved suitable for the purpose; the quality of iron varies very considerably, but the variations are small compared with the variations in steel. Iron is frequently used without testing, although such indiscriminate use of iron is not recommended, but to use steel without proving its quality, is fraught with very great danger; however, if proper precautions be taken to prove that the quality is suitable, and all good makers are quite willing to prove the quality of their steel, it may with much advantage be employed in the construction of boilers, provided that attention be paid to the following :—

Testing and Marking by Makers.

One or more pieces cut from each plate and bar should be tested for tensile strength and elongation, and both results stamped on the plate or bar, when practicable, where they can be easily seen when the boiler is constructed; this should be done by the steel maker, but if by accident it be not done at the steel works, it should be done at the boiler works before the plates are accepted.

Testing and Marking, &c., by Inspectors.

It is very desirable that the Engineer Inspector responsible for the boiler should witness the whole of the tests, but if unable to do so he should select at least one in four of the plates, either at the steel works or in the boiler maker's works, and witness the testing of at least one strip cut from each selected plate ; he should also see that the plates which the maker tests are all properly marked, so that he can afterwards distinguish those he saw tested from those which were tested by the maker, but not in his presence, and so be in a position to know the quality of all the plates. The foregoing as to testing and marking plates also applies to bars for stays and rivets, except that only one in twenty need be tested when not over 1 inch diameter, one in twelve when not over $1\frac{1}{2}$ inch, and one in eight when exceeding $1\frac{1}{2}$ inch.

There should be at least one test piece cut off each end of plates that are 15 feet long or over, and one from each corner when over 20 feet long; if the results of testing are within the prescribed limits, the mean of the results of the tests of the pieces off each end should be stamped on the plate. In all cases where the results of the first tests are unsatisfactory, duplicate and triplicate tests should be made, and if these fulfil the conditions, the plates may be considered suitable.

Working Stress not Over Iron.

If for the plates from which the Inspector selects the foregoing proportions, a greater working stress is wished than is approved of for iron, tests for tensile strength and elongation should be made, and those for which no allowance over iron is wished may be tested for resistance to bending, if preferred. In the latter case, the tensile strength and elongation stamped on each plate by the maker should be noted by the Inspector, as well as the results of the bending tests. In *all* cases some bending tests should be made on strips both tempered and otherwise.

Test Strips or Pieces.

The breadth of test strips for tensile strength should be about 2 inches, and the elongation taken in a length of 10 inches should be about 25 per cent., but never less than 20 per cent. The test strips should be carefully prepared and measured. Sufficient should be cut off the edges of the plates by a planing or shaping machine to remove the injury done by shearing. The test pieces from bars may be prepared in a lathe or by a machine, and should never be heated and worked down under the hammer.

Bending Tests.

The bending tests for plates *not* exposed to flame should be made with strips in their normal condition, and occasionally also some tempering tests should be made ; but strips cut from furnace and combustion box plates, &c., should be heated to a cherry-red, then plunged into water of about 80° F., and kept there until of the same temperature as the water, and then bent. The bending strips should not be less than 2 inches broad and 10 inches long, and they should be bent until they break, or until the sides are parallel at a distance from each other of not more than three times the thickness of the plate, which test they should bear without cracking

Tensile Strength, &c.—Shell Plates.

The tensile strength of the plates *not* exposed to flame should be about 28 tons, and should *not* exceed 32 tons per square inch of section, but the tensile strength of the weakest shell plate, either 26, 27, or 28 tons, etc., should be used in the calculations for the working pressure, if the plates comply with all the conditions which have been previously stated. Unless for very special reasons, it is not advisable to limit the steel maker to a less range than 3 tons ; that is, accept plates, although some of them may be 3 tons stronger than is actually required, *provided all* the conditions previously enumerated are complied with. When steel having a higher tensile strength than that named here has been proved suitable for boilers, the weight of the

boiler may be further reduced, but it is to the steel maker that we must look to accomplish this; but taking into account the effect of corrosion, &c., it is a question which should be well considered before approval is given to the lightening of the scantlings, for, except in a few cases, such will not be economical to shipowners and owners of boilers. When a high tensile strength is aimed at, care should be taken that the ductility and reliability of the plate are not sacrificed.

Tensile Strength, &c.—Furnace and Flanging Plates, &c.

The tensile strength of furnace, flanging, and combustion box plates may range from 26 to 30 tons per square inch, and should have an elongation, taken in 10 inches, of about 25 per cent., and never less than 20 per cent.; it is very desirable that the elongation should not be less than 25 per cent.

Bars, Stays—Tensile Strength, &c.

Bars for stays should be tested. Solid steel screwed stays, which have not been welded or otherwise worked after heating, may have a working stress of 9000 lbs. per square inch of net section, provided the tensile strength be from 27 to 32 tons per square inch, and the elongation in 10 inches about 25 per cent., and not less than 20 per cent.; but if a stress of only about 7000 lbs. per square inch of net section be adopted, it will prevent the necessity of renewing the stays at such an early period in the life of the boiler, and so be more economical, except where a slight saving in weight is of great importance. Steel stays which have been welded or worked in the fire have been found to be unreliable; therefore, they should *not* be used.

Rivets—Tensile Strength, &c.

Bars from which rivets are made should be tested, and generally a few rivets of each size should also be selected, and should be turned and tested for tensile strength, &c. The bars for rivets should be from 26 tons to 30 tons per square inch, and the elongation in 10 inches not less than 25 per cent., and the contraction of area about 60 per cent. The tensile strength of rivets may be from 26 to 32 tons per square inch, and the contraction of area about 60 per cent.

The rivet before being tested should be turned, and the length of the parallel part should be 2·5 times the diameter of the turned part.

Recording the Results of Tests.

The results of all the tests of the plates, bars, rivets, &c., should be tabulated by the Engineer Inspector who witnesses the tests, and carefully preserved for reference.

Annealing.

All plates that are punched, flanged, or locally heated should be carefully annealed after being so treated. The plates should be heated all over at one operation in a properly constructed furnace, and then allowed to cool gradually.

Local Heating.

Local heating of the plates is very objectionable, and should be avoided, as many plates have failed from having been so treated. If this be not attended to, serious accidents are likely to result.

Welded Plates.

Steel plates which have been welded should not be used when subject to a tensile stress, and those welded and subject to a compressive stress should be efficiently annealed in a properly constructed furnace.

Drilling in Place.

The rivet holes in the furnace and shell seams of cylindrical boilers should be drilled after bending. If proper machines be used, it is not only better to drill in place, but drilling is also cheaper than punching.

Punching and Boring.

Punching plates and afterwards boring them is not recommended; but if this is done care should be taken that a sufficient quantity is bored out so as to remove as far as possible the very injurious effect of punching. It is found that when a half inch plate is punched nine-sixteenths inch it requires to be bored out to fully twelve-sixteenths, and an inch plate punched one inch and one-sixteenth requires to be bored out to one inch and five-sixteenths to remove the pernicious effect of the punch on the plates, and consequently plates of greater thickness require to have more bored out so as to remove the injurious effects of punching. There is nothing gained by punching and afterwards boring, and there is also more or less risk of the injury done by the punch not being removed, and therefore such a barbarous tool as a punch should never be used to steel plates.

Punching and Annealing.

Punching plates and afterwards annealing them is decidedly an objectionable method, and before it is done the *special* assent of the Engineer Inspector should be obtained; if he assents, it is essential

that he should satisfy himself that the annealing is done properly and in a properly constructed furnace. Punching the holes before the plates are bent is very objectionable, and generally this cannot be conveniently done afterwards, and as all punching should be avoided it cannot be too strongly urged upon those interested that drilling in place is the only really satisfactory method of perforating the plates. There can seldom or never be any good reason for punching, or punching and afterwards boring, and there are many good reasons why this should not be done. There are several very suitable drilling machines, which are used by all first class boiler makers and found to be of great advantage, and the purchaser of boilers and all interested will be acting with prudence if they object to such inferior work as punching ; they can get first class work for about the same price, and will be less likely to come under the Employers' Liability Act from having used, to say the least, very indifferently constructed if not dangerous boilers.

Riveted Joints for Cylindrical Shells, Receivers, Domes, &c. (Steel).

If the plates for cylindrical shells, receivers, domes, &c., and the rivets, comply with the foregoing conditions, the percentage of strength of any joint or other particulars of the joint may be found by the following formulæ :—

p = Pitch of rivets in inches.
d = Diameter of rivets in inches.
A = Area of one rivet in square inches.
n = Number of rivets in one pitch (greatest pitch).
$\%$ = Percentage of plate left between rivets in greatest pitch.
$\%_1$ = Percentage of rivet section as compared with solid plate.
$\%_2$ = Percentage of combined plate and rivet section when the number of rivets in the second row is twice that in the outer row.
c = 1 for lap or single butt strap joints.
c = 1·75 for double butt strap joints.
T = Thickness of plate in inches.

To find the percentage strength of any given joint—

$$\frac{100(p-d)}{p} = \% \quad . \quad . \quad . \quad (1)$$

$$\frac{100 \times 23 \times A \times n \times c}{28 \times p \times T} = \%_1 \quad . \quad . \quad . \quad (2)$$

When the number of rivets in the second row is twice that in the outer row—

$$\frac{100(p-2d)}{p} + \frac{\%_1}{n} = \%_2 \quad . \quad . \quad . \quad (3)$$

The lowest of the values so found is the percentage strength of the joint.

The use of formula (3) will seldom be found necessary.

In double butt strapped joints % or $\%_1$ is always less than $\%_2$ so long as the diameter of the rivets is not less than the thickness of the plate, and in lap joints when the diameter is not less than $\dfrac{T}{\cdot 64515}$.

To find d when p, c, n, T are known so that % may be equal to $\%_1$—

$$\sqrt{\frac{\cdot 775 \times T}{n \times c}\left\{\frac{\cdot 775 \times T}{n \times c} + 2p\right\}} - \frac{\cdot 775 \times T}{n \times c} = d \quad . \quad . \quad (4)$$

To find p when d, n, c, T are known so that % may be equal to $\%_1$—

$$\frac{23 \times A \times n \times c}{28 \times T} + d = p \quad . \quad . \quad . \quad (5)$$

To find d and p when n, c, T and the required percentages are known—

$$\frac{1{\cdot}55 \times \% \times T}{(100 - \%) \times n \times c} = d \quad . \quad . \quad . \quad (6)$$

$$\frac{100 \times 1{\cdot}55 \times \% \times T}{(100 - \%)^2 \times n \times c} = p \quad . \quad . \quad . \quad (7)$$

Steel Plates and Iron Rivets.

If iron rivets be used in steel plates; to find the particulars of any joint, the foregoing formulæ should be modified as follows:—

In equations (2) and (5) substitute $^8/_{13}$ for $^{23}/_{28}$, in equation (4) substitute 1·0345 for ·775, and in equations (6) and (7) substitute 2·069 for 1·55.

Diagonal Pitches, &c.

Diagonal pitches and thickness of butt straps are found by the formulæ previously given for iron boilers. The diameter of the rivets should not be less than the thickness of the plate.

Pressures on Cylindrical Shells, &c. (Steel).

When determining the working pressure to be allowed for cylindrical shells of boilers, domes, &c., the smallest of the percentages, as found by the preceding formulæ (1), (2), or (3), should be used as the percentage strength of the joint, and the nominal factor of safety should not be less than that found from the table of additions to be made to the factor 4·5 or 5, as given for iron boilers.

The pressure and other particulars may be found by the following formulæ:—

T = Thickness of plate in inches.
D = Inside diameter of boiler in inches.
F = Factor of safety.
r = Lowest of the percentages %, $\%_1$, or $\%_2$ divided by 100.
B = Working pressure per square inch in lbs.

$$* \quad \frac{62720 \times r \times 2T}{D \times F} = B$$

$$* \quad \frac{B \times D \times F}{62720 \times 2 \times r} = T$$

$$* \quad \frac{62720 \times r \times 2T}{B \times F} = D$$

$$* \quad \frac{62720 \times r \times 2T}{D \times B} = F$$

$$* \quad \frac{B \times D \times F}{62720 \times 2T} = r.$$

* If the minimum tensile strength of the shell plates be less or more than 28 tons, the constant 62720 should be modified accordingly. If 26 tons, the constant is 58240 ; if 27 tons, the constant is 60480 ; if 29 tons, it becomes 64960 ; if 30 tons, 67200 ; if 31 tons, 69440 ; and if 32 tons, 71680.

Curved Ends of Cylindrical Boilers (Steel).

The constant given in the previous remarks on iron boilers for curved ends may be increased about one-third, or may be 13000, thus :—

$$\frac{13000 \times r \times T}{R} = B,$$

r being equal to the percentage of plate section (%) divided by 100, T to the thickness of tube plate in inches, R to the radius of curved end in inches, and B to the boiler pressure per square inch in lbs.

If the percentage strength of the horizontal seam above the tubes be less than the percentage strength of the plate left between the tubes, such lesser percentage should be used in calculating the working pressure; and if the plate above the tube plate be of less thickness than the tube plate, its thickness should be used in the formula—that is, the smallest of the products $r \times T$ should be used.

Plates for Furnaces, Combustion Boxes, &c. (Steel).

If the flanging plates and those exposed to flame comply with the conditions stated in the preceding paragraphs relating to such plates, the constants in the rules for iron boilers, which precede these remarks on steel boilers, may be increased as follows :—

Constants for Furnaces (Steel).

The appropriate constants for plain iron furnaces may have 10 per cent. added, or—

$$\frac{1{\cdot}1 \times C \times T^2}{(L+1) \times D} = B,$$

C being the constant applicable to the circumstance of the case or method of construction, T the thickness of plate in inches, L the length of the furnace in feet, D the outside diameter of the furnace in inches, and B the working pressure per square inch in lbs. See Tables Nos. 162 to 174, also Nos. 329 to 341, if above 160 lbs.

The working pressure should not exceed that found by the formula—

$$\frac{9900 \times T}{D} = B.$$

Vertical Furnaces or Fire Boxes (Steel).

In the case of upright fire boxes of donkey or similar boilers, when the decrease in diameter is at least one inch for every foot of height, 10 per cent. should be deducted from the constants applicable for horizontal furnaces with similar descriptions of seams or joints. When the decrease in diameter is less than one inch per foot of height, a greater reduction than 10 per cent. should be made. See Tables Nos. 162 to 174, and notes preceding the Tables, above 160 lbs. Nos. 329 to 341.

Curved Tops of Combustion Boxes (Steel).

The constant suitable for curved tops of iron combustion boxes, as determined by reference to the remarks on *iron* boilers preceding this, may be increased by 10 per cent. The remarks on T bars for stiffening, and the radius of curvature, should be attended to.

Corrugated Furnaces (Steel).

When furnaces are corrugated and machine made, and practically true circles, the working pressure may be found by the following formula,* provided that the plain parts at the ends do not exceed 6 inches in length, and that the plates are not less than $\frac{5}{16}$ inch thick. See Tables Nos. 176 and 177, also No. 343, when above 160 lbs.

* Provided that the pitch of the corrugations is not more than 6 inches, and the depth, including thickness of plate, not less than 2 inches, or the maximum outside diameter not less than 4 inches more than the minimum inside diameter; when the depth of the corrugations is less, the pitches should be proportionally reduced.

T = Thickness of plate in inches.

D = Diameter of furnace, outside at the bottom of the corrugations, in inches.

C = 14000.

B = Working pressure per square inch in lbs.

$$\frac{C \times T}{D} = B$$

$$\frac{C \times T}{B} = D$$

$$\frac{B \times D}{C} = T.$$

If the furnace be riveted in two or more lengths, it may be advisable to reduce the constant.

Constants for Flat Surfaces (Steel).

When flat surfaces are supported by stays, screwed into the plate and riveted over so as to form a substantial head, 10 per cent. may be added to the appropriate constant for iron plates ; or—

$$\frac{1{\cdot}1 \times C \times (t+1)^2}{S-6} = B,$$

C being equal to the constant according to the circumstances of the case, t the thickness of the plate in sixteenths of an inch, S the surface supported in square inches, and B working pressure per square inch in lbs.

When flat surfaces are supported by stays screwed into the plate and nutted, or when the stays are nutted in the steam space, 25 per cent. may be added to the appropriate constant for iron plates, and also when the plates are stiffened by riveted washers or doubling strips and supported by nutted stays, thus :—

$$\frac{1{\cdot}25 \times C \times (t+1)^2}{S-6} = B.$$

The pressures for pitches, about 6 inches and under, should be taken from the Tables Nos. 81 to 109. If above 160 lbs., see Tables Nos. 286 to 314.

Girders for Flat Surfaces (Steel).

The constants applicable for solid wrought iron girders, as given in the preceding remarks on iron boilers, may be increased 10 per cent. when mild steel girders, made of rolled plates and not worked in the fire, are used, or,

$$\frac{1{\cdot}1 \times C \times d^2 \times T}{(W-P)D \times L} = B,$$

C being the constant applicable to the number of bolts fitted, d depth of girder in inches, T thickness of girder in inches, W width of combustion box in inches, P pitch of supporting bolts in inches, D distance between the girders from centre to centre in inches, L length of girder in feet, and B working pressure per square inch in lbs.

The stress on the supporting bolts should not exceed that stated previously in the section on Steel, in clause "Bar Stays," page 42, or the working pressure can be found in Tables No. 110 *et seq.*, also 315 *et seq.*, and the working pressure for the plate can be found by the formula in this section on Steel, clause "Constants for Flat Surfaces," or may be taken from Tables No. 81 *et seq.*, also No. 286 *et seq.*; but when the pitches are about 6 inches or under the pressures from the Tables should *always* be used, and *not* those arrived at by the use of the formula. Above 160 lbs. see Tables 286 *et seq.* and 315 *et seq.*

Crushing Stress on Tube Plates (Steel).

Tube plates should not have a greater working pressure on them than that found by the following formula:—

D = Least horizontal distance between the centres of tubes in inches.
d = Inside diameter of the ordinary tubes in inches.
T = Thickness of the tube plate in inches.
W = Extreme width of combustion box in inches, from the front of tube plate to back of fire box, or the distance between the combustion box tube plates, when the boiler is double ended and the box common to the furnaces at both ends.
C = 20000.
B = Working pressure per square inch in lbs.

$$\frac{(D - d)T \times C}{W \times D} = B$$

$$\frac{B \times W \times D}{(D - d) \times C} = T$$

$$\frac{D - d)T \times C}{B \times D} = W$$

$$\frac{C \times d \times T}{CT - BW} = D$$

$$\frac{D(CT - BW)}{CT} = d$$

Superheaters and Uptakes (Steel).

Although steel may not be considered so suitable for superheaters and the unshielded uptakes of boilers, including those of ordinary vertical donkey boilers, as first-class iron, Engineer Inspectors may assent to its being used; but when they do so the actual strength of the

steel should, in calculating the working pressure, be reduced 36 per cent.

Hemispherical Ends (Steel).

The internal pressure on hemispherical ends made of steel plates, may be found in the same manner as for hemispherical ends made of iron plates ; but the constant 40,000 may be increased to the number represented by the tensile strength of the plates in lbs. per square inch when within the range of 26 to 30 tons, although, as when made of iron, it is generally advisable for the ends to be of the same thickness as the cylindrical part.

Dished Ends (Steel).

Dished ends made of steel should be dealt with in the same manner as those made of iron ; but when solid steel-screwed stays, of suitable quality, which have not been welded or otherwise worked after heating, are used, the stress on them may be 18,000 lbs. per square inch of net section, when the dished ends are theoretically equal to the pressure required when considered as a portion of a sphere. The plates used for dished ends should not exceed in tensile strength 30 tons per square inch.

General Remarks.

If the foregoing remarks in regard to quality, testing, and construction, &c., be attended to, and in other respects the boilers are made in accordance with the conditions for iron boilers, which precede this, steel may be advantageously used for boilers ; but although the steel boiler may be equally safe, or even more so, it is not generally advisable to reduce the scantlings so much below that required for iron boilers, and it is not always to the interest of owners to have boilers made so light. There is a limit to lightness as well as to strength, when new, and when full advantage of the extra strength of steel over iron is taken, the owner ultimately will not get the proper value out of the steel, and it would be better, in *some* cases, to use first class iron than to reduce the thickness of the plate and sizes of stays, &c., so that the strength when new of the steel boiler is only equal to that of a good iron one.

Having regard to the extra material required to keep the steel scantlings a little above the minimum given in the foregoing remarks, it will not always prove economical to sanction the scantlings being run down to the lowest possible margin of strength when new. So long as the general custom is to lower the scantlings, so long will it suit makers to use the minimum quantity of material, and in doing so they are only doing that which may be considered as fair in trade, when competition is keen and each maker guarantees to be up to given standards.

Those interested should remember that standards as to scantlings of steel boilers, like other things, are generally minimum scantlings as to safety, and *not* standards as to ultimate economy; therefore in many cases on the score of ultimate economy, it would be well were only about half the allowance over iron that safety admits when the boiler is new taken advantage of, and in a large number of cases it would ultimately be to the interest of those who have to pay for the boiler and for keeping it in an efficient condition, were the scantlings kept up to the same standard as given previously for iron boilers.

Although this has been stated, it should not be thought that good mild steel is despised or looked upon with distrust in comparison with good iron; on the contrary, use steel, but use it with discretion, and if properly treated, it will turn out as good as, or even better than, iron. This is said after thirty-seven years' experience of steel, and although that made so long ago had not exactly the same physical properties as that now made, nevertheless the material was such that boilers made of it then stood well when judiciously treated; the failures in years past were in many cases traced to the manipulation which the material received in the boiler shop, and to injudicious treatment of the boilers. Experiments made thirty-seven years ago on the steel then made showed that the tensile strength was in some cases nearly double that of iron, but the tensile strength of that now made varies from about that of iron to about 30 per cent. in excess, such as is generally used in boilers. It was claimed for it that its tenacity was equal in all directions, and the tensile strength with and across the grain of that now made does not *generally* differ much. It has been stated that the steel of the period in question was as ductile and malleable as copper; however that may have been, it is an undoubted fact that some of it was as capable of being bent and flanged as the best iron, and that with proper care it stood as well in the boilers of that time as any iron. In no case where steel has been judiciously used has the writer known it to turn out worse than iron, if such a quality as could be made were used and proper precautions were taken, and in almost every case when it has not come up to the expectations of those interested, good reasons could be given for its not succeeding and turning out better than iron.

BOILERS, GENERAL REMARKS.

NEUTRAL PARTS OF SHELLS, MANHOLES, STEAM PIPES, FITTINGS, TESTING, EXAMINATION, LIFTING FOR INSPECTION, SETTING, &c.

Neutral Parts of Shells.

It is essential that the neutral part of boiler shells under steam domes should be efficiently stiffened and stayed, and this may be done by stays from the shell to the top of dome, or gusset stays attached to the shell and sides of dome. If by stays to the top of the dome, large washers well bedded should be fitted under the nuts inside the shell of the boiler, or T bars may be riveted circumferentially to the top of the shell of the boiler, and the stays attached to the T bars. The size of the stays should not be less than those for dished ends.

Manholes, Mudholes, and Openings.

The openings in the shells of cylindrical boilers should have their *shorter* axis placed longitudinally.

All manholes, mudholes, and other openings should be strengthened and stiffened with compensating rings of at least the same effective sectional area as the part of the plate cut out. In no case should a plate ring be less in thickness than the plate to which it is attached. A flanged plate ring riveted on inside the manhole or mudhole opening makes a very good job; the edge should be faced, then a good joint can be made with the door. A ring of *iron* angle or T bar riveted on the outside with the weld placed at the larger axis makes an efficient job, but welded steel rings or plates should not be used round openings.

Manhole and Mudhole Doors.

The doors should always be fitted inside the boiler, if practicable. The bolts should be screwed into the door, with a shoulder or collar, with a nut inside, and the ends of the bolts riveted over. There should be four bolts in large doors which are *not* embossed, but two bolts are generally sufficient in large embossed doors, and one in very small ones. The size of bolts must depend on the circumstances of each case. Except in the case of very small mudhole or sight doors, the diameter of the bolts should not be less than one and one quarter inch. The doors should fit well, and so prevent the material used for making the joints getting blown out. They should be made from wrought iron or steel plate from about ·4 to 1 inch thick, according to size and pressure ; the doubling plate should be about one half the thickness of the plate to which it is riveted. Embossed steel doors are recommended.

Cast manhole or mudhole doors should not be fitted.

Cross Bars for Manhole and Mudhole Doors.

Manhole doors should not have less than two cross bars, nor should mudhole doors unless they be very small.

The cross bars should always be forged out of the solid, and if the holes are punched or drifted when hot, proper dies, &c., should be used, but drilling the holes makes a first class job. The feet or ends should bed well on the strengthening ring round the opening, or, if the ring is inside, on the part of the shell to which the ring is riveted.

Openings in Boiler Shells, Superheaters, Steam Receivers and Domes.

All holes cut for mountings should have wrought iron or steel plates and rings riveted round the openings, and the plate rings at the thinnest part should be at least as thick as the plate they are riveted on, with true and flat surfaces on the top of the rings; this not only compensates for the part cut out, but enables a steam-tight joint to be *easily* made, more particularly in the case of cylindrical shells. The net section of the ring should not be less than the part cut out—in general it will be found better to make it greater; it is also advisable to have the diameter of the ring larger than the diameter of the flange which is to be jointed to it. In cases where the tube plate is carried down to stiffen the openings over the furnaces, and mountings are fitted on such parts, rings are not necessary, and a true surface can easily be made for the flanges of the mountings or fittings.

Steam Stop Valves or Cocks.

Each boiler should be fitted with a stop valve, and it should be connected directly to the boiler, the neck of the casting being as short as practicable. When two or more boilers are connected with the steam receiver or superheater, a stop valve should be fitted between each boiler and the steam receiver or superheater. This is necessary to avoid the failure of all the boilers through the failure of one.

When the boiler is very small, a cock attached directly to the boiler may answer the purpose of a stop valve, but the neck of the cock should be as short as is practicable, and should be attached to the boiler by a flange.

When the stop valve cannot be attached directly to the boiler, a short length of wrought iron pipe, made of the highest quality of iron plate, should be riveted to the boiler, and the stop valve attached to the pipe. In such cases the pipe should be made considerably thicker than required for the pressure when new, so as to allow for corrosion, as it will waste much more rapidly than the shell of the boiler.

It is desirable that arrangements should be made so that the stop valve can be shut without going on the boiler, and when practicable it should be so arranged for marine boilers that it can be shut from the deck.

Expansion Joints for Steam Pipes.

Expansion joints should be fitted to steam pipes, and there should be a fixed collar with bolts fitted so as to prevent the end of the pipe

being forced out of the socket. This is particularly desirable in the case of bent steam pipes which are fitted with socket expansion joints, and even when the steam pipes are straight the ends are liable to be forced out of the sockets.

Steam Pipes.

Copper steam pipes should be made of the best material and of ample strength for the pressure to which they are to be subjected ; solid drawn pipes are preferable to those which are brazed.

Cast iron steam pipes are not recommended, and if used they should be carefully examined and drilled in several places, so that their thickness may be accurately ascertained.

When made of cast iron, extra precautions as to expansion joints are absolutely necessary.

All steam pipes should be particularly examined and tested by cold water ; *new* pipes to about two and a half or three times the working pressure.

Neither cast iron nor copper steam pipes should pass through the uptake, or be subjected to the impact of heat or flame. When a steam pipe passes through the uptake, it should be made of the highest quality of wrought iron and shielded from the impact of flame.

Glass Water Gauges.

There should be at least one glass water gauge fitted to each boiler, but it is desirable to have two.

A boiler which is fired from both ends should have at least two glass water gauges—that is, one at each end.

A marine boiler of an *unusual* width should have at least two glass water gauges ; and if of an *unusual* width, and fired from both ends, each boiler should have four glass water gauges.

When the fittings for the glass water gauge are not attached directly to the boiler, but to a hollow casting or pipe, there should always be a cock directly on the boiler at the top and bottom ends of the casting or pipe, unless there is a plug or cock on the latter. When there are no cocks between the boiler and the pipes, hollow casting, or column, the bore of the pipes, hollow casting, or column should not be less than 3 inches.

If a cock be fitted so that communication through the hollow casting or pipe, between the top and bottom of the glass can be stopped without shutting either the top or bottom gauge glass cock, then it can be ascertained if the height of the water, as it appears in the glass, correctly indicates the height of water in the boiler without interfering with the cocks directly on the boiler, which are at the ends of the hollow casting or pipe ; and such an arrangement is very desirable, when the glass water gauge is attached to a hollow casting or pipe, as the absence of such a cock may be very serious. When cocks have not been on the ends of the castings or pipes, the want of such a cock placed in the position described has led to disastrous results.

It is desirable, more particularly when the pressure is high, that the fittings are such that the cocks can be shut without the risk of scalding when the glass breaks, and when practicable it is desirable that arrangements are made so that the glass water gauge can be tried from the starting platform.

Asbestos-fitted cocks, such as made by Dewrance or by Hopkinson, are recommended. Hopkinson's Equilibrium and Absolute gauges are substantial and well made; both firms turn out first-class boiler fittings.

Water Test Cocks.

Each boiler should have at least three water test cocks.

A marine boiler that is fired from both ends should have at least three water test cocks at each end.

A marine boiler of *unusual* width should have at least six water test cocks; and if in addition to being of an unusual width the boiler is fired from both ends, there should be at least twelve water test cocks fitted to each boiler.

The test cocks should *not* be fitted to the hollow casting or pipe to which glass water gauges are sometimes attached, but should be attached directly to the boiler, or each by a separate pipe to the boiler. Test cocks on a stand pipe, when the passage in the pipe is permanently closed, are worse than useless.

Asbestos-fitted cocks are those which are recommended; those made by Dewrance or by Hopkinson are well and substantially made.

Steam Pressure Gauges.

There should be at least one pressure gauge fitted to each boiler.

When a boiler is fired from both ends, there should not be less than two pressure gauges fitted to each boiler—that is, one at each end.

Duplex pressure gauges are those which are recommended.

Lights for Gauge Glasses and Steam Gauges.

There should always be suitable fittings for lights and efficient means provided, so that the glass water gauges and pressure gauges can be distinctly seen at all times.

Blow-off Cocks.

The blow-off cock should be fitted directly on the boiler, and the neck of the cock should be as short as practicable. The neck and flange of the cock should be of ample strength, and it is most desirable that a wrought iron or steel plate ring be riveted to the shell of the boiler, considerably larger in diameter than the flange of the cock, and that the cock be attached to the ring plate, instead of being attached directly to the shell. This not only adds strength to the boiler, but greatly does away with the chance of the shell becoming dangerously corroded, owing to the joint leaking.

Guards for Blow-off Cocks.

There should be guards fitted to all blow-off cocks, so that the spanner or handle cannot be taken off unless the cock be shut; this is *essential* when the cock is below the plates, or not always distinctly in sight, and is desirable in whatever position the cock may be placed. In any case where the cock is always visible, and the arrangement is such that there is no guard fitted, the spanner or handle should be securely fixed to the plug of the cock, and not merely shrunk on. On board ship, in addition to the cock directly on the boiler, there should be one placed directly on the skin of the vessel, or on the side of the Kingston valve; and the same arrangement of spanners, with guards, &c., should be fitted as in the case of the cock directly on the boiler. Kingston valves are not now generally fitted.

Scum or Brine Cocks.

The scum or brine cock or valve should be attached directly to the boiler, and the handle of the cock should be securely fixed to the plug, not merely shrunk on; and if it be so placed that it is not always visible and easy of access, there should be a guard fitted so that the handle or spanner cannot be taken off when the cock is open.

Feed Cocks or Valves.

There should be separate feed arrangements fitted in addition to and also unconnected with the main feed pipes and valves. In the case of very small boilers, an efficient hand pump, by which the boilers can be fed when steam is up, may be in some cases found sufficient, but it should not be considered so unless properly tried; it is desirable that a donkey engine be fitted for working the additional feeding arrangements which are separate and independent of the main feeds.

It is most desirable that there should be a non-return valve fitted between the feed cock or valve and feed pipe, and so arranged that when the feed cock or valve is shut, the non-return valve can be taken out and any defects remedied; and when there is a separate inlet for each feed, which is most desirable, one can be at work while the other feed is shut off, and the non-return valve is being put right.

There should be a separate feed cock or feed valve to each boiler; but when this is not the case, there should be a non-return valve, with an adjusting screw on each boiler between the single feed cock or feed valve and the boiler; one cock or valve to feed more than one boiler is impracticable.

Necks of Valves and Cocks.

The necks of all valves and cocks should be as short as practicable, but when they are obliged to be of an unusual length they should be well and efficiently bracketed, and the flanges thicker, and an extra number of bolts or studs fitted, for attaching them to the boiler, or the bolts or studs should be considerably larger.

Testing Boilers by Hydraulic Pressure.

All new boilers should be tested by hydraulic pressure to twice the working pressure, but not above that; the working pressure should only be fixed after the boiler has been carefully examined inside and outside, the method of construction considered, and the working pressure should not exceed that found by the formulæ preceding this, or by the use of the Tables. If the test be not satisfactory, and any defects are observed, they should be made good, and the boiler again subjected to twice the working pressure.

Steam chests, receivers, domes, and superheaters should be tested in the same manner, and the pressure fixed in the same way, care being taken that they are, by the preceding rules applicable to them, fit for the same pressure as the boiler.

Testing and Examining Small Boilers, &c.

If any boiler be too small to allow the Inspector to get inside, the working pressure should not be fixed until the case has had careful consideration, and the boiler should be tested by hydraulic pressure at least every twelve months. If it be only stays which prevent the Engineer Inspector getting in, they should be removed; but it is essential that he should, before finally approving of the efficiency of the boiler, see that they are properly replaced.

Examination of Boilers.

Previous to finally examining any boiler, with a view to fixing the working pressure, it should be thoroughly cleaned inside and out, and it should be cool enough to enable a thorough examination to be made, and until it has been thoroughly cleaned and carefully examined the working pressure should not be fixed; all plates the thickness of which is in any way doubtful should be drilled, so that their actual thickness be ascertained. Superheater plates, steam space plates, and those under and in proximity to the bridges, should be frequently drilled, as they are specially liable to get thin.

Baffle or Shield Plates.

Baffle or shield plates should be fitted to the flat ends of boilers, as far as the steam space extends, also to the ends of superheaters, where exposed to the hot gases, &c.; in the uptake, all plates on which the direct impact of heat or flame acts, being very liable to be injured unless water be in contact with them on the one side, should be efficiently protected by baffle or shield plates.

Lifting Boilers for Inspection.

When all the outside of any boiler cannot be seen, it should be lifted from its seat and thoroughly inspected *at least* once in every four years.

It may be advisable to reduce the pressure before the expiration of four years, if the boiler be not lifted, so as to enable the Inspector to satisfy himself as to its efficiency for the pressure.

If for special reasons it is not wished to lift a boiler, the circumstances of the case should be *specially* considered, so that the efficiency of the boiler for a short time and for the pressure wished may be decided.

When any boiler is lifted, all temporary patches, if any, should be removed and permanent ones riveted on.

All boilers when lifted for inspection or for other reasons should be tested by hydraulic pressure to twice what they are intended to be worked at, after all the repairs are made and before they are reset. A record should be made by the Inspector of the test—as to when made, the condition of the boiler, and what repairs, if any, have been made, and by whom.

Setting and Fixing Boilers.

Before a boiler is set the outside of the bottom should be thoroughly scraped and well rubbed with sandstone, then well brushed with a hard brush and painted with two coats of red lead, which should be well ground and mixed; each coat of paint should be allowed to harden thoroughly, and when the last coat is well hardened, a coat of coal tar should be applied, and when it is quite hard the boiler can be set or fixed. In the case of land boilers set in brick-work, it is necessary that all lime be kept away from the boiler plates ; it is also very desirable that the boiler be bedded in red lead, as when this is done the plates do not corrode, the cost will ultimately be more than amply repaid, and the chance of explosion greatly lessened. If the boiler be on board ship, care should be taken that the boiler be set so that there is as little chance as possible of bilge water getting to the plates.

Want of such precautions shortens the life of a boiler, besides frequently contributing to that which is worse, viz., an explosion.

Land boilers, after about twenty years' work, have been found free from corrosion outside, they having been always painted and set, &c., at the suggestion of the writer, as stated above.

RIVETING (IRON AND STEEL).

Joints of Special Construction.

Formulæ have been given in a former part of the book, for ascertaining the proportions and finding the value of riveted joints as usually made, but by what follows the value of joints of special construction may be determined, such as joints in which the rivets are not all of the same diameter, or in the case of joints where some of the rivets are in single shear and some in double shear, or where the rivets are of different diameters, as well as some of them being in single shear and some in double shear.

The formulæ which follow are applicable when the rivets in any one row are of the same diameter, although the diameters may differ in each row.

The formulæ are also applicable to ordinary joints, although not so convenient for use when applied to such joints as the formulæ previously given for ordinary riveting.

p_1 = Pitch of rivets in inches in outer row.
p_2 = Pitch of rivets in inches in second row.
p_3 = Pitch of rivets in inches in third row.
p_4 = Pitch of rivets in inches in fourth row.
d_1 = Diameter of rivets in inches in outer row.
d_2 = Diameter of rivets in inches in second row.
d_3 = Diameter of rivets in inches in third row.
d_4 = Diameter of rivets in inches in fourth row.
A_1 = Area of one rivet in square inches in outer row.
A_2 = Area of one rivet in square inches in second row.
A_3 = Area of one rivet in square inches in third row.
A_4 = Area of one rivet in square inches in fourth row.
$\%_{P1}$ = Percentage of plate left between rivets in outer row.
$\%_{P2}$ = Percentage of plate left between rivets in second row.
$\%_{P3}$ = Percentage of plate left between rivets in third row.
$\%_{P4}$ = Percentage of plate left between rivets in fourth row.
$\%_{R_1}$ = Percentage of rivet section in outer row as compared with solid plate.
$\%_{R_2}$ = Percentage of rivet section in second row as compared with solid plate.
$\%_{R_3}$ = Percentage of rivet section in third row as compared with solid plate.
$\%_{R_4}$ = Percentage of rivet section in fourth row as compared with solid plate.
C = 1 when the rivets are in single shear.
C = 1·75 when the rivets are in double shear.
T = Thickness of plate, in inches.

$$\frac{100(p_1 - d_1)}{p_1} = \%P_1$$

$$\frac{100(p_2 - d_2)}{p_2} = \%P_2$$

$$\frac{100(p_3 - d_3)}{p_3} = \%P_3$$

$$\frac{100(p_4 - d_4)}{p_4} = \%P_4$$

$$* \frac{100 \times A_1 \times C}{p_1 \times T} = \%R_1$$

$$* \frac{100 \times A_2 \times C}{p_2 \times T} = \%R_2$$

$$* \frac{100 \times A_3 \times C}{p_3 \times T} = \%R_3$$

$$* \frac{100 \times A_4 \times C}{p_4 \times T} = \%R_4$$

Having found the percentages by the foregoing formulæ, the percentage value of the joint is determined as follows:—

Value at outer row	=	$\%P_1$.
Value at second row	=	$\%P_2 + \%R_1$.
Value at third row	=	$\%P_3 + \%R_1 + \%R_2$.
Value at fourth row	=	$\%P_4 + \%R_1 + \%R_2 + \%R_3$.
Value of rivets	=	$\%R_1 + \%R_2 + \%R_3 + \%R_4$.

The lowest of the values so found is the percentage value of the joint.

The working pressure for iron boilers is found by the formula

$$\dagger \frac{47000 \times r \times 2T}{D \times F} = B,$$

B being the working pressure, T the thickness of the plate, r the percentage applicable divided by 100, D the diameter of the boiler, and F the *nominal* factor of safety. See formula for iron boilers page 24.

Diagonal Pitches.

The value of the metal in the diagonal pitch is only about five-sixths of what it is in the horizontal pitch, therefore the net section in the diagonal pitch should be one-fifth greater than it is in the horizontal pitch, or in the part of the horizontal pitch to which it is required to be equivalent in strength.

* If steel plates and steel rivets, multiply by $\frac{23}{28}$.

† If steel plates, substitute 62720 for 47000, if 28 tons steel, but for any other tensile strength the number which it represents in lbs. per square inch should be used.

Thickness of Butt Straps.

The *minimum* thickness of butt straps is found by the following formulæ :—

T = Thickness of plate in inches.
T_1 = Thickness of each butt strap in inches (minimum).

$$\frac{5 \text{ (Plate percentage at outer row)} \times T}{8 \text{ (Plate percentage at inner row)}} = T_1 \text{ Double butt straps;}$$

$$\frac{9 \text{ (Plate percentage at outer row)} \times T}{8 \text{ (Plate percentage at inner row)}} = T_1 \text{ Single butt straps.}$$

Flanged Mouthpieces (Iron and Steel), Flat Surfaces.

The piece cut out before flanging should be cut by machine if practicable, but, if not, it should be drilled out, never punched. The edge of the flange should be "trued up" so as to enable a tight joint to be made. The flange should not be jumped up ; but when the plate is of less thickness than, say about $\frac{5}{8}$ inch, a flanged ring may be tightly fitted on the flange and both faces trued up together ; this will insure a good surface, and enable a tight joint to be made. Solid recessed doors are very suitable for flanged mouthpieces.

The depths given in the following Table include the thickness of the plate.

The width of the material used for making the joint of doors which are not recessed for the flange should be considerably in excess of the thickness of the flange.

The jointing material should *not* be square or round.

When the door is recessed, the jointing material should be a tight fit in the recess, and the recess should not be too easy a fit for the thickness of the flange.

FLANGED MOUTHPIECES (Iron and Steel).—FLAT SURFACES. Table No. 1.

Thickness of Plate in inches.	W 3 ins.	W 4 ins.	W 5 ins.	W 6 ins.	W 7 ins.	W 8 ins.	W 9 ins.	W 10 ins.	W 11 ins.	W 12 ins.	W 13 ins.	W 14 ins.	W 15 ins.
T	D	D	D	D	D	D	D	D	D	D	D	D	D
1/4	7/8	1	1 1/8	1 1/4	1 5/16	1 7/16	1 1/2	1 9/16	1 11/16	1 3/4	1 13/16	1 7/8	1 15/16
9/32	15/16	1 1/16	1 3/16	1 5/16	1 3/8	1 1/2	1 9/16	1 11/16	1 3/4	1 13/16	1 15/16	2	2 1/16
5/16	15/16	1 1/8	1 1/4	1 3/8	1 1/2	1 9/16	1 11/16	1 3/4	1 7/8	1 15/16	2	2 1/16	2 3/16
11/32	1	1 3/16	1 5/16	1 7/16	1 9/16	1 11/16	1 3/4	1 7/8	1 15/16	2	2 1/8	2 3/16	2 1/4
3/8	1 1/16	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4	1 13/16	1 15/16	2	2 1/8	2 3/16	2 5/16	2 3/8
13/32	1 1/8	1 1/4	1 7/16	1 9/16	1 11/16	1 13/16	1 15/16	2	2 1/8	2 3/16	2 5/16	2 3/8	2 7/16
7/16	1 1/8	1 5/16	1 1/2	1 5/8	1 3/4	1 7/8	2	2 1/16	2 3/16	2 5/16	2 3/8	2 1/2	2 9/16
15/32	1 3/16	1 3/8	1 1/2	1 11/16	1 13/16	1 15/16	2 1/16	2 3/16	2 1/4	2 3/8	2 7/16	2 9/16	2 5/8
1/2	1 1/4	1 7/16	1 9/16	1 3/4	1 7/8	2	2 1/8	2 1/4	2 3/8	2 7/16	2 9/16	2 5/8	2 3/4
17/32	1 1/4	1 7/16	1 5/8	1 13/16	1 15/16	2 1/16	2 3/16	2 5/16	2 7/16	2 1/2	2 5/8	2 3/4	2 13/16
9/16	1 5/16	1 1/2	1 11/16	1 13/16	2	2 1/8	2 1/4	2 3/8	2 1/2	2 5/8	2 11/16	2 13/16	2 7/8
19/32	1 5/16	1 9/16	1 3/4	1 7/8	2 1/16	2 3/16	2 5/16	2 7/16	2 9/16	2 11/16	2 3/4	2 7/8	3
5/8	1 3/8	1 9/16	1 3/4	1 15/16	2 1/16	2 1/4	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	2 15/16	3 1/16
21/32	1 3/8	1 5/8	1 13/16	2	2 1/8	2 5/16	2 7/16	2 9/16	2 11/16	2 13/16	2 15/16	3	3 1/8
11/16	1 7/16	1 11/16	1 7/8	2	2 3/16	2 3/8	2 1/2	2 5/8	2 3/4	2 7/8	3	3 1/8	3 3/16

The depths of the compensating flanges are intended for openings whose length does not exceed 1·5 time the width of the opening of the manhole or mudhole.

T = Thickness of plate in inches. W = Width of opening in inches. D = Depth of flange in inches.

FLANGED MOUTHPIECES (IRON AND STEEL).—FLAT SURFACES. TABLE NO. 1 *continued.*

Thickness of Plate in inches.	W 3 ins.	W 4 ins.	W 5 ins.	W 6 ins.	W 7 ins.	W 8 ins.	W 9 ins.	W 10 ins.	W 11 ins.	W 12 ins.	W 13 ins.	W 14 ins.	W 15 ins.
T	D	D	D	D	D	D	D	D	D	D	D	D	D
23/32	1 7/16	1 11/16	1 7/8	2 1/16	2 1/4	2 3/8	2 9/16	2 11/16	2 13/16	2 15/16	3 1/16	3 3/16	3 5/16
3/4	1 1/2	1 3/4	1 15/16	2 1/8	2 5/16	2 7/16	2 5/8	2 3/4	2 7/8	3	3 1/8	3 1/4	3 3/8
25/32	1 1/2	1 3/4	2	2 3/16	2 5/16	2 1/2	2 5/8	2 13/16	2 15/16	3 1/16	3 3/16	3 5/16	3 7/16
13/16	1 9/16	1 13/16	2	2 3/16	2 3/8	2 9/16	2 11/16	2 7/8	3	3 1/8	3 1/4	3 3/8	3 1/2
27/32	1 9/16	1 13/16	2 1/16	2 1/4	2 7/16	2 5/8	2 3/4	2 7/8	3 1/16	3 3/16	3 5/16	3 7/16	3 9/16
7/8	1 5/8	1 7/8	2 1/16	2 5/16	2 1/2	2 5/8	2 13/16	2 15/16	3 1/8	3 1/4	3 3/8	3 1/2	3 5/8
29/32	1 5/8	1 7/8	2 1/8	2 5/16	2 1/2	2 11/16	2 7/8	3	3 3/16	3 5/16	3 7/16	3 9/16	3 11/16
15/16	1 11/16	1 15/16	2 3/16	2 3/8	2 9/16	2 3/4	2 7/8	3 1/16	3 3/16	3 3/8	3 1/2	3 5/8	3 3/4
31/32	1 11/16	1 15/16	2 3/16	2 7/16	2 5/8	2 13/16	2 15/16	3 1/8	3 1/4	3 7/16	3 9/16	3 11/16	3 13/16
1	1 3/4	2	2 1/4	2 7/16	2 5/8	2 13/16	3	3 3/16	3 5/16	3 7/16	3 5/8	3 3/4	3 7/8
1 1/32	1 3/4	2	2 1/4	2 1/2	2 11/16	2 7/8	3 1/16	3 3/16	3 3/8	3 1/2	3 11/16	3 13/16	3 15/16
1 1/16	1 13/16	2 1/16	2 5/16	2 1/2	2 3/4	2 15/16	3 1/16	3 1/4	3 7/16	3 9/16	3 11/16	3 7/8	4
1 3/32	1 13/16	2 1/16	2 5/16	2 9/16	2 3/4	2 15/16	3 1/8	3 5/16	3 7/16	3 5/8	3 3/4	3 15/16	4 1/16
1 1/8	1 13/16	2 1/8	2 3/8	2 5/8	2 13/16	3	3 3/16	3 3/8	3 1/2	3 11/16	3 13/16	3 15/16	4 1/8

The depths of the compensating flanges are intended for openings whose length does not exceed 1·5 time the width of the opening of the manhole or mudhole.

T = Thickness of plate in inches. W = Width of opening in inches. D = Depth of flange in inches.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plates.

In the Tables Nos. 2 to 30, which immediately follow, and Nos. 225 to 253, Pitches are given from about 21 inches to 3·5 inches, and surfaces from about 440 square inches to 12 square inches, with the thickness of plates and Pressures suitable for the different Pitches and Surfaces, according to the particular conditions under which the Pressures, Pitches, and Surfaces are applicable. The Pressures range from 5 lbs. to 200 lbs. per square inch. The thickness of the plates ranges from $\frac{1}{4}$ to $1\frac{1}{8}$ inch, each Table advancing by $\frac{1}{32}$ of an inch.

The following notes and remarks will facilitate the use of the Tables Nos. 2 to 30 and Nos. 225 to 253.

The distinguishing letters over the different Columns in each Table, refer to the conditions under which the Pitches and Surfaces are suitable for the Working Pressure opposite the particular Pitch and Surface, when the plates are of the thickness given at the head of the Table; and, consequently, opposite the particular Pressures will be found the Pitches and Surfaces suitable for the Working Pressure for the thickness of plate at the head of the Table.

The following are the conditions to which each distinguishing letter in the Tables refers; they show under which distinguishing letter the Pitches and Surfaces should be looked for in the Table for the suitable thickness of plate :—

Distinguishing Letters.		Distinguishing Letters.
A.	If the plates are *not* exposed to the impact of heat or flame, and the stays are fitted with nuts and strips of at least the thickness of the plates they cover, and of a width of not less than $\frac{2}{3}$ the pitch of the stays, and the strips are properly riveted to the outside of the plates; then the maximum Working Pressure is that found opposite the Pitch or Surface in Column	A.
B.	If the plates are *not* exposed to the impact of heat or flame, and the stays are fitted with nuts and washers of at least the thickness of the plates they cover, and of a diameter not less than $\frac{2}{3}$ the pitch of the stays, and the washers are properly riveted on the outside of the plates; then, the maximum Working Pressure is that found opposite the Pitch or Surface in Column	B.
C.	If the plates are *not* exposed to the impact of heat or flame, and the stays are fitted with nuts and washers of at least $\frac{2}{3}$ the thickness of the plates they cover, and of a diameter of not less than three times the diameter of the stay over the thread; then the maximum Working Pressure is that found opposite the Pitch or Surface in Column . .	C.

Distinguishing Letters. | Distinguishing Letters.

D. If the plates are *not* exposed to the impact of heat or flame, and the stays are fitted with nuts only ; then the maximum Working Pressure is that found opposite the Pitch or Surface in Column . . . . D.

E. If the plates are exposed to the impact of heat or flame, and water is in contact with the plates, and the stays are screwed into the plates, and fitted with nuts ; then, the maximum Working Pressure is that found opposite the Pitch or Surface in Column . . . . . . E.

F. If the plates are *not* exposed to the impact of heat or flame, and water is in contact with the plates, and the stays are screwed into the plates, and the ends of the stays are riveted over so that substantial heads are formed ; then the maximum Working Pressure is that found opposite the Pitch or Surface in Column . . . . . . F.

G. If the plates are exposed to the impact of heat or flame, and steam is in contact with the plates, and the stays are fitted with nuts and washers of at least ⅔ the thickness of the plates they cover, and of a diameter not less than three times the diameter of the stay, over the thread ; then the maximum Working Pressure is that found opposite the Pitch or Surface in Column . . . . . . G.

G. If the plates are exposed to the impact of heat or flame, and water is in contact with the plates, and the stays are screwed into the plates, and the ends of the stays are riveted over so that substantial heads are formed ; then the maximum Working Pressure is that found opposite the Pitch or Surface in Column . . . . . . G.

H. If the plates are exposed to the impact of heat or flame, and steam is in contact with the plates, and the stays are fitted with nuts only ; then the maximum Working Pressure is that found opposite the Pitch or Surface in Column, . . H.

I. If the plates are exposed to impact of heat or flame, and steam is in contact with the plates, and the stays are screwed into the plates, and the ends of the stays are riveted over so as to form substantial heads ; then the maximum Working Pressure is that found opposite the Pitch or Surface in Column . . . . . . I.

In any case where the material or workmanship is defective, or the nuts or ends of the stays, &c., are defective, the Working Pressure should be less than that found opposite the Pitches and Surfaces, which are applicable for cases where all is first class as to material, workmanship, and condition.

The following examples will further facilitate the use of the Tables :—

(1) To find the Working Pressure for a given Thickness of Iron Plate and a given Pitch or Surface :—

If the Iron Plate be $^9/_{16}$ inch thick, the Surface 70, and Pitch 8·36 inches, and the conditions of the case make the Surface and Pitch in column E applicable ; in Table No. 12, which is for $^9/_{16}$ inch Iron Plates, in column E, the surface 70 is found, and the Pitch 8·36, or say $8\frac{3}{8}$ inches, opposite which the Pressure is 125 lbs. per square inch.

(2) To find the Pitch or Surface for a given Pressure and a given Thickness of Iron Plate :—

If the Iron Plate be $^9/_{16}$ inch thick and the Pressure 125 lbs. per square inch, and the conditions of the case make it necessary to select the Surface in column E ; in Table No. 12, which is for $^9/_{16}$ inch Iron Plates, opposite 125 lbs. in Column E, is found 70, which is the Surface in square inches, the Pitch being 8·36 or, say, $8\frac{3}{8}$ inches.

(3) To find the thickness of Iron Plate for a given Pitch or Surface and a given Pressure :—

If the Surface be 70 square inches and the Pressure 125 lbs. per square inch, and the conditions of the case make it necessary to select the Surface or Pitch in column E ; then, opposite 125 lbs. Pressure, the Surface 70, and Pitch 8·36 or, say, $8\frac{3}{8}$ inches, are found in Column E in Table No. 12, and the Thickness of the Iron Plate is found to be $^9/_{16}$ inch.

Or, if W = Working Pressure, P = Pitch, S = Surface, and T = Thickness of Iron Plate, and if A, B, C, D, E, F, G, H and I are the letters at the heads of the different Columns, indicating the Columns where the Surface applicable to the case must be looked for, then : –

(1) To find W—— when T = 1 inch, S = 408, P = 20·2, and A the distinguishing letter of Column from which the Surfaces or Pitch must be selected :—

In Table No. 26 for 1 inch Iron Plates, in Column A the Surface 408 is found, and opposite the Surface is 115 lbs., which is the Working Pressure required to be found.

(2) To find S or P—— when T = 1 inch, W = 115 lbs., and A the distinguishing letter of Column in which the Surface or Pitch must be looked for :—

In the Table No. 26 for 1 inch Iron Plates, and opposite 115 lbs. in Column A, 408 and 20·2 are found, which are the Surface and Pitch required.

(3) To find T—— when W = 115 lbs., S = 408, P = 20·2, and A the distinguishing letter of Column in which the Surface must be selected :—

As the Surface and Pitch are large, and the Pressure moderately high, the Iron Plates must be thick, and on looking down Table No. 26 for 1 inch Iron Plates, opposite 115 lbs. in Column A, are found 408 and 20·2 ; therefore T = 1 inch, which is the Thickness of Iron Plates required to be found.

If in any of the foregoing examples, the Pitches only, or the Surfaces only, had been under consideration instead of both Pitches and Surfaces, the method of ascertaining either would have been exactly the same as the Pitches and Surfaces in each case are given opposite the Pressure under the distinguishing letter applicable to the case.

The Pitches are given in inches and decimal parts of an inch; the latter can, if required, be easily converted into vulgar fractions, and when this is done, if the decimal part is not found equal to say $1/16$ part of an inch, it is advisable in practice to make the pitch to the sixteenth below, and such a small difference will be on the side of safety. If, for example, the Pitch in the Table be 20·2 inches, it may in practice be $20\,3/16$ inches, if vulgar fractions be preferred to decimals. As it is desirable that flat surfaces should be supported by stays forming squares, the following Tables have been prepared for Surfaces with stays pitched in squares, or nearly so. When there is a *considerable* difference in the Pitches, it is thought prudent that the Pressure should *not* be so great; therefore, when the surface to be supported is obtained by the product of two Pitches which are *considerably* different, the Pressure which may be used will *not* be that opposite the Surface, but may be easily found.

For example—

If the Pitches are as 4 to 3, the Pressure opposite the Surface or product of the two Pitches may be reduced about 4 per cent.; when as 3 to 2, about 8 per cent.; when as 5 to 3, about 12 per cent.; and when as 2 to 1, the reduction of Pressure may be about 20 per cent.

The thicknesses given in the Tables are intended to provide for stresses due to the steam pressure upon the stayed flat plate, and when a flat plate is subjected to additional stresses, such stresses should be duly considered. These additional stresses may be tensile or compressive; in both cases the thickness of the plate should be adequately increased, or other efficient means adopted to meet the requirements of the case.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{1}{4}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	20·15	406·0
10	20·15	406·0	19·52	381·0	16·00	256·0	15·19	231·0	14·35	206·0
15	16·51	272·6	16·00	256·0	13·14	172·6	12·49	156·0	11·80	139·3
20	14·35	206·0	13·91	193·5	11·44	131·0	10·88	118·5	10·29	106·0
25	12·88	166·0	12·49	156·0	10·29	106·0	9·79	96·0	9·27	86·0
30	11·80	139·3	11·44	131·0	9·45	89·3	9·00	81·0	8·52	72·6
35	10·96	120·2	10·63	113·1	8·80	77·4	8·38	70·2	7·94	63·1
40	10·29	106·0	9·98	99·7	8·27	68·5	7·89	62·2	7·48	56·0
45	9·74	94·8	9·45	89·3	7·84	61·5	7·48	56·0	7·10	50·4
50	9·27	86·0	9·00	81·0	7·48	56·0	7·14	51·0	6·78	46·0
55	...	...	...	...	7·17	51·4	6·84	46·9	6·50	42·3
60	...	...	...	...	6·90	47·6	6·59	43·5	6·27	39·3
65	...	...	...	...	6·66	44·4	6·37	40·6	6·04	36·4
70	...	...	...	...	6·45	41·7	6·17	38·1	5·78	33·4
75	...	...	...	...	6·27	39·3	5·95	35·4	5·56	30·9
80	...	...	...	...	6·09	37·1	5·73	32·8	5·36	28·7
85	...	...	...	...	5·88	34·5	5·53	30·6	5·19	26·9
90	...	...	...	...	5·69	32·3	5·36	28·7	5·04	25·4
95	...	...	...	...	5·52	30·4	5·21	27·1	4·90	24·0
100	...	...	...	...	5·36	28·7	5·07	25·7	4·78	22·8
105	...	...	...	...	5·22	27·3	4·95	24·5	4·67	21·8
110	...	...	...	...	5·10	26·0	4·83	23·3	4·57	20·8
115	...	...	...	...	4·98	24·8	4·73	22·3	4·47	20·0
120	...	...	...	...	4·88	23·8	4·63	21·5	4·39	19·3
125	...	...	...	...	4·78	22·8	4·55	20·7	4·31	18·6
130	...	...	...	...	4·69	22·0	4·47	19·9	4·24	18·0
135	...	...	...	...	4·61	21·2	4·39	19·3	4·17	17·4
140	...	...	...	...	4·53	20·5	4·32	18·7	4·11	16·9
145	...	...	...	...	4·46	19·9	4·26	18·1	4·06	16·4
150	...	...	...	...	4·39	19·3	4·20	17·6	4·00	16·0
155	...	...	...	...	4·33	18·7	4·14	17·1	3·93	15·4
160	...	...	...	...	4·27	18·2	4·09	16·7	3·87	15·0
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{1}{4}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	18·53	343·5	17·49	306·0	16·61	276·0	13·63	186·0
10	13·22	174·7	12·49	156·0	11·87	141·0	9·79	96·0
15	10·88	118·4	10·29	106·0	9·79	96·0	8·12	66·0
20	9·50	90·3	9·00	81·0	8·57	73·5	7·14	51·0
25	8·57	73·5	8·12	66·0	7·74	60·0	6·48	42·0
30	7·89	62·2	7·48	56·0	7·14	51·0	5·95	35·4
35	7·36	54·2	6·99	48·8	6·67	44·5	5·45	29·7
40	6·94	48·1	6·59	43·5	6·30	39·7	5·07	25·7
45	6·59	43·4	6·27	39·3	5·95	35·4	4·78	22·8
50	6·30	39·7	5·95	35·4	5·60	31·3	4·55	20·7
55	6·03	36·3	5·63	31·7	5·31	28·2	4·36	19·0
60	5·73	32·8	5·36	28·7	5·07	25·7	4·20	17·6
65	5·47	30·0	5·14	26·4	4·87	23·7	4·06	16·5
70	5·26	27·6	4·95	24·5	4·70	22·0	3·92	15·4
75	5·07	25·7	4·78	22·8	4·55	20·7	3·79	14·4
80	4·91	24·1	4·63	21·5	4·41	19·5	3·67	13·5
85	4·76	22·7	4·50	20·3	4·30	18·5	3·56	12·7
90	4·63	21·5	4·39	19·3	4·20	17·6	...	...
95	4·52	20·4	4·29	18·4	4·10	16·8	...	...
100	4·41	19·5	4·20	17·6	4·02	16·2	...	...
105	4·32	18·7	4·11	16·9	3·92	15·4	...	...
110	4·23	17·9	4·04	16·3	3·83	14·7	...	...
115	4·16	17·3	3·95	15·6	3·75	14·0	...	...
120	4·09	16·7	3·87	15·0	3·67	13·5	...	...
125	4·02	16·2	3·79	14·4	3·60	12·9	...	...
130	3·94	15·5	3·72	13·8	3·53	12·4	...	...
135	3·87	15·0	3·65	13·3	...	...	...	...
140	3·80	14·4	3·58	12·8	...	...	...	...
145	3·73	13·9	3·52	12·4	...	...	...	...
150	3·67	13·5	...	...	...	...	...	...
155	3·61	13·0	...	...	...	...	...	...
160	...	...	...	...	...	...	...	...
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{9}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	..
10	...	...	...	...	17·56	308·5	16·68	278·2	15·74	248·0
15	18·13	328·6	17·56	308·5	14·41	207·6	13·69	187·5	12·93	167·3
20	15·74	248·0	15·26	232·8	12·54	157·2	11·92	142·1	11·27	127·0
25	14·12	199·6	13·69	187·5	11·27	127·0	10·72	114·9	10·14	102·8
30	12·93	167·3	12·54	157·2	10·33	106·8	9·83	96·7	9·31	86·6
35	12·01	144·2	11·64	135·6	9·61	92·4	9·15	83·7	8·66	75·1
40	11·27	127·0	10·92	119·4	9·03	81·6	8·60	74·0	8·15	66·5
45	10·65	113·5	10·33	106·8	8·55	73·2	8·15	66·5	7·73	59·7
50	10·14	102·8	9·83	96·7	8·15	66·5	7·77	60·4	7·37	54·4
55	9·69	94·0	9·40	88·5	7·81	61·0	7·45	55·5	7·07	50·0
60	9·31	86·6	9·03	81·6	7·51	56·4	7·16	51·3	6·80	46·3
65	...	...	...	...	7·24	52·5	6·92	47·8	6·57	43·2
70	...	...	..	...	7·01	49·2	6·70	44·8	6·37	40·5
75	...	...	...	...	6·80	46·3	6·50	42·3	6·18	38·2
80	...	...	...	...	6·62	43·8	6·32	40·0	5·98	35·7
85	...	...	...	...	6·44	41·5	6·16	38·0	5·77	33·3
90	...	...	...	...	6·29	39·6	5·98	35·7	5·58	31·2
95	...	...	...	...	6·15	37·8	5·79	33·5	5·42	29·3
100	...	...	...	...	5·98	35·7	5·62	31·6	5·27	27·8
105	...	...	...	...	5·81	33·7	5·47	29·9	5·13	26·4
110	..	...	...	...	5·65	32·0	5·33	28·4	5·01	25·1
115	...	...	...	...	5·51	30·4	5·21	27·1	4·90	24·0
120	...	...	...	...	5·39	29·0	5·09	25·9	4·80	23·0
125	...	...	...	...	5·27	27·8	4·99	24·9	4·70	22·1
130	...	...	...	...	5·16	26·6	4·89	23·9	4·62	21·3
135	...	...	...	...	5·06	25·6	4·80	23·0	4·54	20·6
140	...	...	...	. .	4·97	24·7	4·71	22·2	4·46	19·9
145	...	...	...	..	4·88	23·8	4·64	21·5	4·39	19·3
150	...	...	...	...	4·80	23·0	4·56	20·8	4·33	18·7
155	...	...	...	...	4·72	22·3	4·50	20·2	4·27	18·2
160	...	...	...	...	4·65	21·6	4·43	19·6	4·21	17·7
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Table No. 3 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{9}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	20·35	414·3	19·21	369·0	18·24	332·7	14·96	223·8
10	14·49	210·1	13·69	187·5	13·01	169·3	10·72	114·9
15	11·92	142·1	11·27	127·0	10·72	114·9	8·86	78·6
20	10·39	108·0	9·83	96·7	9·36	87·6	7·77	60·4
25	9·36	87·6	8·86	78·6	8·44	71·3	7·04	49·5
30	8·60	74·0	8·15	66·5	7·77	60·4	6·50	42·3
35	8·02	64·3	7·60	57·8	7·25	52·6	6·08	36·9
40	7·55	57·0	7·16	51·3	6·84	46·8	5·62	31·6
45	7·16	51·3	6·80	46·3	6·50	42·3	5·27	27·8
50	6·84	46·8	6·50	42·3	6·21	38·6	4·99	24·9
55	6·56	43·1	6·24	39·0	5·91	34·9	4·76	22·6
60	6·32	40·0	5·98	35·7	5·62	31·6	4·56	20·8
65	6·11	37·3	5·70	32·5	5·38	28·9	4·40	19·4
70	5·85	34·2	5·47	29·9	5·17	26·7	4·26	18·1
75	5·62	31·6	5·27	27·8	4·99	24·9	4·14	17·1
80	5·42	29·4	5·09	25·9	4·83	23·3	4·03	16·3
85	5·25	27·5	4·94	24·4	4·69	22·0	3·92	15·3
90	5·09	25·9	4·80	23·0	4·56	20·8	3·81	14·5
95	4·95	24·5	4·67	21·8	4·45	19·8	3·70	13·7
100	4·83	23·3	4·56	20·8	4·35	18·9	3·61	13·0
105	4·71	22·2	4·46	19·9	4·26	18·1	3·52	12·4
110	4·61	21·3	4·37	19·1	4·18	17·4	...	...
115	4·52	20·4	4·29	18·4	4·10	16·8	...	...
120	4·43	19·6	4·21	17·7	4·03	16·3	...	...
125	4·35	18·9	4·14	17·1	3·96	15·6	...	...
130	4·28	18·3	4·07	16·6	3·88	15·0	...	...
135	4·21	17·7	4·01	16·1	3·81	14·5	..	...
140	4·15	17·2	3·94	15·5	3·74	14·0	...	...
145	4·09	16·7	3·87	15·0	3·67	13·5	...	...
150	4·03	16·3	3·81	14·5	3·61	13·0	...	...
155	3·97	15·8	3·74	14·0	3·55	12·6	...	...
160	3·91	15·3	3·69	13·6	3·50	12·2	...	...
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{5}{16}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	19·13	366·0	18·16	330·0	17·14	294·0
15	19·74	390·0	19·13	366·0	15·68	246·0	14·90	222·0	14·07	198·0
20	17·14	294·0	16·61	276·0	13·63	186·0	12·96	168·0	12·24	150·0
25	15·36	236·0	14·90	222·0	12·24	150·0	11·64	135·6	11·01	121·2
30	14·07	198·0	13·63	186·0	11·22	126·0	10·67	114·0	10·10	102·0
35	13·06	170·5	12·66	160·2	10·43	108·8	9·92	98·5	9·39	88·2
40	12·24	150·0	11·87	141·0	9·79	96·0	9·32	87·0	8·83	78·0
45	11·57	134·0	11·22	126·0	9·27	86·0	8·83	78·0	8·36	70·0
50	11·01	121·2	10·67	114·0	8·83	78·0	8·41	70·8	7·97	63·6
55	10·52	110·7	10·20	104·1	8·45	71·4	8·05	64·9	7·64	58·3
60	10·10	102·0	9·79	96·0	8·12	66·0	7·74	60·0	7·34	54·0
65	9·72	94·6	9·43	89·0	7·83	61·3	7·47	55·8	7·09	50·3
70	9·39	88·2	9·11	83·1	7·57	57·4	7·23	52·2	6·86	47·1
75	9·10	82·8	...	...	7·34	54·0	7·01	49·2	6·66	44·4
80	...	...	...	...	7·14	51·0	6·82	46·5	6·48	42·0
85	...	...	...	...	6·95	48·3	6·64	44·1	6·31	39·8
90	...	...	...	...	6·78	46·0	6·48	42·0	6·16	38·0
95	...	...	...	...	6·62	43·3	6·33	40·1	5·98	35·8
100	...	...	...	...	6·48	42·0	6·19	38·4	5·81	33·7
105	...	...	...	...	6·34	40·2	6·05	36·6	5·65	31·9
110	...	...	...	...	6·22	38·7	5·88	34·6	5·50	30·2
115	...	...	...	...	6·10	37·2	5·73	32·9	5·37	28·8
120	...	...	...	...	5·95	35·4	5·60	31·3	5·25	27·5
125	...	...	...	...	5·81	33·7	5·47	29·9	5·13	26·3
130	...	...	...	...	5·68	32·2	5·35	28·7	5·03	25·3
135	...	...	...	...	5·56	30·9	5·25	27·5	4·93	24·3
140	...	...	...	...	5·45	29·7	5·15	26·5	4·85	23·5
145	...	...	...	...	5·34	28·5	5·05	25·5	4·76	22·7
150	...	...	...	...	5·25	27·5	4·97	24·7	4·69	21·9
155	...	...	...	...	5·16	26·6	4·88	23·8	4·61	21·3
160	...	...	...	...	5·07	25·7	4·81	23·1	4·55	20·7
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 4 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{5}{16}$ inch thick.

Pressure per sq. in	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	20·92	438·0	19·87	394·8	16·28	265·2
10	15·78	249·0	14·90	222·0	14·15	200·4	11·64	135·6
15	12·96	168·0	12·24	150·0	11·64	135·6	9·61	92·4
20	11·29	127·5	10·67	114·0	10·15	103·2	8·41	70·8
25	10·15	103·2	9·61	92·4	9·15	83·7	7·60	57·8
30	9·32	87·0	8·83	78·0	8·41	70·8	7·01	49·2
35	8·68	75·4	8·22	67·7	7·84	61·5	6·56	43·4
40	8·17	66·7	7·74	60·0	7·39	54·6	6·19	38·0
45	7·74	60·0	7·34	54·0	7·01	49·2	5·81	33·7
50	7·39	54·6	7·01	49·2	6·70	44·8	5·47	29·9
55	7·08	50·1	6·72	45·2	6·43	41·3	5·20	27·0
60	6·82	46·5	6·48	42·0	6·19	38·4	4·97	24·7
65	6·58	43·3	6·26	39·2	5·94	35·2	4·77	22·8
70	6·38	40·7	6·05	36·6	5·69	32·3	4·61	21·2
75	6·19	38·4	5·81	33·7	5·47	29·9	4·46	19·9
80	5·99	35·9	5·60	31·3	5·28	27·9	4·34	18·8
85	5·78	33·4	5·41	29·3	5·11	26·1	4·22	17·8
90	5·60	31·3	5·25	27·5	4·97	24·7	4·13	17·0
95	5·43	29·5	5·10	26·0	4·83	23·3	4·04	16·3
100	5·28	27·9	4·97	24·7	4·71	22·2	3·94	15·5
105	5·15	26·5	4·85	23·5	4·61	21·2	3·84	14·8
110	5·02	25·2	4·74	22·4	4·51	20·3	3·76	14·1
115	4·91	24·1	4·64	21·5	4·42	19·5	3·67	13·5
120	4·81	23·1	4·55	20·7	4·34	18·8	3·60	12·9
125	4·71	22·2	4·46	19·9	4·26	18·1	3·52	12·4
130	4·63	21·4	4·38	19·2	4·19	17·5	...	...
135	4·55	20·7	4·31	18·6	4·13	17·0	...	...
140	4·47	20·0	4·25	18·0	4·07	16·5	...	...
145	4·40	19·4	4·18	17·5	4·01	16·1	...	...
150	4·34	18·8	4·13	17·0	3·94	15·5	...	...
155	4·28	18·3	4·07	16·6	3·88	15·0	...	...
160	4·22	17·8	4·02	16·2	3·81	14·5	...	...
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{11}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	20·70	428·5	19·65	386·2	18·54	344·0
15	...	...	20·70	428·5	16·96	287·6	16·10	259·8	15·21	231·3
20	18·54	344·0	17·96	322·8	14·74	217·2	14·00	196·0	13·22	175·0
25	16·62	276·4	16·11	259·5	13·22	175·0	12·57	158·1	11·88	141·2
30	15·21	231·3	14·74	217·2	12·11	146·8	11·52	132·7	10·89	118·6
35	14·11	199·1	13·67	187·0	11·25	126·7	10·70	114·6	10·12	102·5
40	13·22	175·0	12·82	164·4	10·56	111·6	10·05	101·0	9·51	90·5
45	12·49	156·2	12·11	146·8	9·99	99·8	9·51	90·5	9·00	81·0
50	11·88	141·2	11·52	132·7	9·51	90·5	9·05	82·0	8·58	73·6
55	11·35	128·9	11·01	121·2	9·10	82·8	8·66	75·1	8·21	67·4
60	10·89	118·6	10·56	111·6	8·74	76·4	8·33	69·3	7·89	62·3
65	10·48	110·0	10·17	103·5	8·42	71·0	8·03	64·5	7·61	58·0
70	10·12	102·5	9·82	96·5	8·14	66·3	7·76	60·3	7·36	54·2
75	9·80	96·1	9·51	90·5	7·89	62·3	7·53	56·7	7·14	51·0
80	9·51	90·5	9·23	85·2	7·66	58·8	7·31	53·5	6·94	48·2
85	9·24	85·5	...	...	7·46	55·7	7·12	50·7	6·76	45·7
90	9·00	81·0	...	...	7·27	52·9	6·94	48·2	6·60	43·5
95	...	...	...	...	7·10	50·4	6·78	46·0	6·44	41·5
100	...	...	...	...	6·94	48·2	6·63	44·0	6·30	39·8
105	...	...	...	...	6·80	46·2	6·49	42·2	6·18	38·1
110	...	...	...	...	6·66	44·4	6·37	40·5	6·03	36·4
115	...	...	...	...	6·53	42·7	6·25	39·0	5·87	34·5
120	...	...	...	...	6·42	41·2	6·13	37·6	5·73	32·9
125	...	...	...	...	6·30	39·8	6·00	36·0	5·60	31·4
130	...	...	...	...	6·20	38·5	5·86	34·3	5·48	30·0
135	...	...	...	...	6·10	37·2	5·73	32·9	5·37	28·8
140	...	...	...	...	5·97	35·6	5·61	31·5	5·26	27·7
145	...	...	...	...	5·85	34·2	5·51	30·3	5·17	26·7
150	...	...	...	...	5·73	32·9	5·40	29·2	5·07	25·7
155	...	...	...	...	5·63	31·6	5·31	28·2	4·99	24·9
160	...	...	...	...	5·53	30·5	5·22	27·2	4·91	24·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{11}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	17·61	310·2
10	17·06	291·1	16·11	259·5	15·30	234·1	12·57	158·1
15	14·00	196·0	13·22	175·0	12·57	158·1	10·36	107·4
20	12·19	148·5	11·52	132·7	10·95	120·0	9·05	82·0
25	10·95	120·0	10·36	107·4	9·86	97·2	8·17	66·8
30	10·05	101·0	9·51	90·5	9·05	82·0	7·53	56·7
35	9·35	87·4	8·85	78·4	8·43	71·1	7·03	49·4
40	8·79	77·2	8·33	69·3	7·94	63·0	6·63	44·0
45	8·33	69·3	7·89	62·3	7·53	56·7	6·30	39·8
50	7·94	63·0	7·53	56·7	7·18	51·6	6·00	36·0
55	7·60	57·8	7·21	52·0	6·89	47·4	5·67	32·2
60	7·31	53·5	6·94	48·2	6·63	44·0	5·40	29·2
65	7·06	49·8	6·70	45·0	6·41	41·1	5·18	26·8
70	6·83	46·7	6·49	42·2	6·21	38·5	4·98	24·8
75	6·63	44·0	6·30	39·8	6·00	36·0	4·81	23·1
80	6·45	41·6	6·14	37·6	5·77	33·3	4·66	21·7
85	6·28	39·5	5·92	35·1	5·58	31·1	4·53	20·5
90	6·13	37·6	5·73	32·9	5·40	29·2	4·42	19·5
95	5·95	35·4	5·56	30·9	5·25	27·5	4·31	18·6
100	5·77	33·3	5·40	29·2	5·11	26·1	4·22	17·8
105	5·61	31·5	5·26	27·7	4·98	24·8	4·14	17·1
110	5·47	29·9	5·13	26·4	4·87	23·7	4·06	16·5
115	5·34	28·5	5·02	25·2	4·76	22·7	3·98	15·8
120	5·22	27·2	4·91	24·1	4·66	21·7	3·90	15·2
125	5·11	26·1	4·81	23·1	4·58	20·9	3·82	14·6
130	5·00	25·0	4·72	22·3	4·49	20·2	3·74	14·0
135	4·91	24·1	4·64	21·5	4·42	19·5	3·67	13·5
140	4·82	23·2	4·56	20·8	4·35	18·9	3·61	13·0
145	4·74	22·5	4·49	20·1	4·28	18·3	3·54	12·5
150	4·66	21·7	4·42	19·5	4·22	17·8	...	...
155	4·59	21·1	4·35	18·9	4·16	17·3	...	...
160	4·53	20·5	4·29	18·4	4·11	16·9	...	...
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{3}{8}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	19·95	398·0
15	...	...	...	...	18·24	332·6	17·32	300·0	16·35	267·3
20	19·95	398·0	19·32	373·5	15·84	251·0	15·05	226·5	14·21	202·0
25	17·87	319·6	17·32	300·0	14·21	202·0	13·50	182·4	12·76	162·8
30	16·35	267·3	15·84	251·0	13·01	169·3	12·37	153·0	11·69	136·6
35	15·16	230·0	14·69	216·0	12·08	146·0	11·49	132·0	10·86	118·0
40	14·21	202·0	13·77	189·7	11·33	128·5	10·78	116·2	10·19	104·0
45	13·42	180·2	13·01	169·3	10·71	114·8	10·19	104·0	9·65	93·1
50	12·76	162·8	12·37	153·0	10·19	104·0	9·70	94·2	9·18	84·4
55	12·18	148·5	11·81	139·6	9·75	95·0	9·28	86·1	8·79	77·2
60	11·69	136·6	11·33	128·5	9·36	87·6	8·91	79·5	8·44	71·3
65	11·25	126·6	10·91	119·0	9·02	81·3	8·59	73·8	8·14	66·3
70	10·86	118·0	10·53	111·0	8·71	76·0	8·30	69·0	7·87	62·0
75	10·51	110·5	10·19	104·0	8·44	71·3	8·05	64·8	7·63	58·2
80	10·19	104·0	9·89	97·8	8·20	67·2	7·81	61·1	7·41	55·0
85	9·91	98·2	9·61	92·4	7·97	63·6	7·60	57·8	7·22	52·1
90	9·65	93·1	9·36	87·6	7·77	60·4	7·41	55·0	7·04	49·5
95	9·40	88·5	9·13	83·3	7·58	57·5	7·24	52·4	6·87	47·2
100	9·18	84·4	...	...	7·41	55·0	7·07	50·1	6·72	45·2
105	...	...	...	...	7·25	52·6	6·92	48·0	6·58	43·3
110	...	...	...	...	7·11	50·5	6·78	46·0	6·45	41·6
115	...	...	...	...	6·97	48·6	6·66	44·3	6·33	40·0
120	...	...	...	...	6·84	46·8	6·53	42·7	6·21	38·6
125	...	...	...	...	6·72	45·2	6·42	41·2	6·10	37·3
130	...	...	...	...	6·61	43·6	6·31	39·9	5·96	35·6
135	...	...	...	...	6·50	42·2	6·21	38·6	5·83	34·0
140	...	...	...	...	6·40	41.0	6·12	37·5	5·71	32·6
145	...	...	...	...	6·30	39·7	5·99	35·9	5·60	31·4
150	...	...	...	...	6·21	38·6	5·88	34·5	5·49	30·2
155	...	...	...	...	6·13	37·6	5·77	33·2	5·40	29·1
160	...	...	...	...	6·02	36·2	5·66	32·0	5·30	28·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 6 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{3}{8}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	18·94	358·8
10	18·35	336·7	17·32	300·0	16·45	270·6	13·50	182·4
15	15·05	226·5	14·21	202·0	13·50	182·4	11·11	123·6
20	13·09	171·3	12·37	153·0	11·76	138·3	9·70	94·2
25	11·76	138·3	11·11	123·6	10·57	111·8	8·75	76·5
30	10·78	116·2	10·19	104·0	9·70	94·2	8·05	64·8
35	10·02	100·5	9·48	90·0	9·03	81·6	7·51	56·4
40	9·41	88·6	8·91	79·5	8·49	72·1	7·07	50·1
45	8·91	79·5	8·44	71·3	8·05	64·8	6·72	45·2
50	8·49	72·1	8·05	64·8	7·67	58·9	6·42	41·2
55	8·13	66·1	7·71	59·4	7·35	54·1	6·17	38·0
60	7·81	61·1	7·41	55·0	7·07	50·1	5·88	34·5
65	7·54	56·8	7·15	51·2	6·83	46·7	5·61	31·5
70	7·29	53·2	6·92	48·0	6·61	43·8	5·39	29·0
75	7·07	50·0	6·72	45·2	6·42	41·2	5·19	26·9
80	6·88	47·3	6·53	42·7	6·25	39·0	5·02	25·2
85	6·70	44·9	6·37	40·5	6·08	36·9	4·87	23·7
90	6·53	42·7	6·21	38·6	5·88	34·5	4·73	22·4
95	6·38	40·8	6·06	36·7	5·70	32·4	4·61	21·3
100	6·25	39·0	5·88	34·5	5·53	30·6	4·50	20·3
105	6·12	37·5	5·71	32·6	5·39	29·0	4·41	19·4
110	5·95	35·4	5·56	31·0	5·25	27·6	4·32	18·6
115	5·80	33·7	5·43	29·5	5·13	26·3	4·24	17·9
120	5·66	32·0	5·30	28·1	5·02	25·2	4·16	17·3
125	5·53	30·6	5·19	26·9	4·92	24·2	4·09	16·7
130	5·41	29·3	5·08	25·8	4·82	23·2	4·03	16·2
135	5·30	28·1	4·99	24·9	4·73	22·4	3·96	15·6
140	5·20	27·1	4·90	24·0	4·65	21·6	3·88	15·1
145	5·11	26·1	4·81	23·1	4·57	20·9	3·82	14·5
150	5·02	25·2	4·73	22·4	4·50	20·3	3·75	14·1
155	4·94	24·3	4·66	21·7	4·44	19·7	3·69	13·6
160	4·86	23·6	4·59	21·0	4·38	19·1	3·63	13·2
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{13}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	19·52	381·0	18·53	343·5	17·49	306·0
20	...	...	20·68	427·8	16·94	287·2	16·09	259·1	15·19	231·0
25	19·13	366·0	18·53	343·5	15·19	231·0	14·44	208·5	13·63	186·0
30	17·49	306·0	16·94	287·2	13·91	193·5	13·22	174·7	12·49	156·0
35	16·22	263·1	15·71	247·0	12·91	166·7	12·27	150·6	11·60	134·5
40	15·19	231·0	14·72	216·9	12·10	146·6	11·51	132·5	10·88	118·5
45	14·35	206·0	13·91	193·5	11·44	131·0	10·88	118·5	10·29	106·0
50	13·63	186·0	13·22	174·7	10·88	118·5	10·35	107·2	9·79	96·0
55	13·02	169·6	12·62	159·4	10·40	108·2	9·90	98·0	9·37	87·8
60	12·49	156·0	12·10	146·6	9·98	99·7	9·50	90·3	9·00	81·0
65	12·02	144·4	11·65	135·8	9·62	92·5	9·15	83·8	8·67	75·2
70	11·60	134·5	11·24	126·5	9·29	86·3	8·85	78·3	8·38	70·2
75	11·22	126·0	10·88	118·5	9·00	81·0	8·57	73·5	8·12	66·0
80	10·88	118·5	10·55	111·4	8·73	76·3	8·32	69·2	7·89	62·2
85	10·57	111·8	10·26	105·2	8·49	72·1	8·09	65·5	7·67	58·9
90	10·29	106·0	9·98	99·7	8·27	68·5	7·89	62·2	7·48	56·0
95	10·03	100·7	9·73	94·8	8·07	65·2	7·70	59·2	7·30	53·3
100	9·79	96·0	9·50	90·3	7·89	62·2	7·52	56·6	7·14	51·0
105	9·57	91·7	9·29	86·3	7·71	59·5	7·36	54·2	6·99	48·8
110	9·37	87·8	9·09	82·7	7·55	57·1	7·21	52·0	6·84	46·9
115	9·18	84·2	...	...	7·41	54·9	7·07	50·0	6·71	45·1
120	9·00	81·0	...	...	7·27	52·8	6·94	48·1	6·59	43·5
125	...	...	...	...	7·14	51·0	6·82	46·5	6·48	42·0
130	...	...	...	...	7·02	49·2	6·70	44·9	6·37	40·6
135	...	...	...	...	6·90	47·6	6·59	43·5	6·27	39·3
140	...	...	...	...	6·79	46·1	6·49	42·1	6·17	38·1
145	...	...	...	...	6·69	44·7	6·39	40·9	6·07	36·8
150	...	...	...	...	6·59	43·5	6·30	39·7	5·95	35·4
155	...	...	...	...	6·50	42·2	6·21	38·6	5·83	34·0
160	...	...	...	...	6·41	41·1	6·13	37·6	5·73	32·8
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.
Iron Plate $\frac{13}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	20·27	411·0
10	19·63	385·6	18·53	343·5	17·60	309·7	14·44	208·5
15	16·09	259·1	15·19	231·0	14·44	208·5	11·87	141·0
20	13·99	195·8	13·22	174·7	12·56	157·8	10·35	107·2
25	12·56	157·8	11·87	141·0	11·29	127·5	9·32	87·0
30	11·51	132·5	10·88	118·5	10·35	107·2	8·57	73·5
35	10·70	114·4	10·12	102·4	9·63	92·7	7·99	63·8
40	10·04	100·9	9·50	90·3	9·05	81·9	7·52	56·6
45	9·50	90·3	9·00	81·0	8·57	73·5	7·14	51·0
50	9·05	81·9	8·57	73·5	8·17	66·7	6·82	46·5
55	8·66	75·0	8·20	67·3	7·82	61·2	6·54	42·8
60	8·32	69·2	7·89	62·2	7·52	56·6	6·30	39·7
65	8·02	64·4	7·61	57·9	7·26	52·7	6·08	37·0
70	7·76	60·2	7·36	54·2	7·02	49·3	5·82	33·9
75	7·52	56·6	7·14	51·0	6·82	46·5	5·60	31·3
80	7·31	53·4	6·94	48·1	6·63	43·9	5·40	29·1
85	7·11	50·6	6·76	45·7	6·46	41·7	5·23	27·3
90	6·94	48·1	6·59	43·5	6·30	39·7	5·07	25·7
95	6·78	45·9	6·44	41·5	6·16	37·9	4·93	24·3
100	6·63	43·9	6·30	39·7	5·99	35·9	4·81	23·1
105	6·49	42·1	6·17	38·1	5·82	33·9	4·70	22·0
110	6·36	40·5	6·03	36·3	5·67	32·1	4·59	21·1
115	6·24	39·0	5·87	34·5	5·53	30·5	4·50	20·2
120	6·13	37·6	5·73	32·8	5·40	29·1	4·41	19·5
125	5·99	35·9	5·60	31·3	5·28	27·9	4·34	18·8
130	5·85	34·3	5·47	30·0	5·17	26·7	4·26	18·2
135	5·73	32·8	5·36	28·8	5·07	25·7	4·20	17·6
140	5·61	31·5	5·26	27·6	4·98	24·8	4·13	17·1
145	5·50	30·3	5·16	26·6	4·89	23·9	4·07	16·6
150	5·40	29·1	5·07	25·7	4·81	23·1	4·02	16·2
155	5·30	28·1	4·99	24·9	4·73	22·4	3·96	15·6
160	5·21	27·2	4·91	24·1	4·66	21·7	3·89	15·1
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{7}{16}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	20·80	432·6	19·74	390·0	18·63	347·3
20	...	...	...	...	18·05	326·0	17·14	294·0	16·18	262·0
25	20·38	415·6	19·74	390·0	16·18	262·0	15·37	236·4	14·51	210·8
30	18·63	347·3	18·05	326·0	14·81	219·3	14·07	198·0	13·29	176·6
35	17·28	298·5	16·74	280·2	13·74	188·8	13·06	170·5	12·34	152·2
40	16·18	262·0	15·68	246·0	12·88	166·0	12·24	150·0	11·57	134·0
45	15·28	233·5	14·81	219·3	12·17	148·2	11·57	134·0	10·94	119·7
50	14·51	210·8	14·07	198·0	11·57	134·0	11·01	121·2	10·41	108·4
55	13·86	192·1	13·43	180·5	11·06	122·3	10·52	110·7	9·95	99·0
60	13·29	176·6	12·88	166·0	10·61	112·6	10·10	102·0	9·55	91·3
65	12·78	163·5	12·39	153·6	10·22	104·4	9·72	94·6	9·20	84·7
70	12·34	152·2	11·96	143·1	9·87	97·4	9·39	88·2	8·89	79·1
75	11·93	142·5	11·57	134·0	9·55	91·3	9·10	82·8	8·61	74·2
80	11·57	134·0	11·22	126·0	9·27	86·0	8·83	78·0	8·36	70·0
85	11·24	126·4	10·90	118·9	9·01	81·2	8·58	73·7	8·13	66·2
90	10·94	119·7	10·61	112·6	8·78	77·1	8·36	70·0	7·93	62·8
95	10·66	113·7	10·34	107·0	8·56	73·3	8·16	66·6	7·74	59·8
100	10·41	108·4	10·10	102·0	8·36	70·0	7·97	63·6	7·56	57·2
105	10·17	103·5	9·87	97·4	8·18	66·9	7·80	60·8	7·40	54·7
110	9·95	99·0	9·65	93·2	8·01	64·1	7·64	58·3	7·24	52·5
115	9·75	95·0	9·46	89·4	7·85	61·6	7·49	56·0	7·10	50·5
120	9·55	91·3	9·27	86·0	7·70	59·3	7·34	54·0	6·97	48·6
125	9·37	87·9	9·10	82·8	7·56	57·2	7·21	52·0	6·85	46·9
130	9·20	84·7	...	...	7·43	55·2	7·09	50·3	6·73	45·3
135	9·04	81·8	...	...	7·30	53·4	6·97	48·6	6·62	43·9
140	...	...	...	...	7·19	51·7	6·86	47·1	6·52	42·5
145	...	...	...	...	7·08	50·1	6·76	45·7	6·42	41·3
150	...	...	...	...	6·97	48·6	6·66	44·4	6·33	40·1
155	...	...	...	...	6·87	47·2	6·57	43·1	6·24	39·0
160	...	...	...	...	6·78	46·0	6·48	42·0	6·16	38·0
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 8. *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{7}{16}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	..	...	...	...	...	...	...
10	20·92	438·0	19·74	390·0	18·75	351·6	15·37	236·4
15	17·14	294·0	16·18	262·0	15·37	236·4	12·63	159·6
20	14·90	222·0	14·07	198·0	13·37	178·8	11·01	121·2
25	13·37	178·8	12·63	159·6	12·01	144·2	9·90	98·1
30	12·24	150·0	11·57	134·0	11·01	121·2	9·10	82·8
35	11·37	129·4	10·75	115·7	10·23	104·7	8·47	71·8
40	10·67	114·0	10·10	102·0	9·61	92·4	7·97	63·6
45	10·10	102·0	9·55	91·3	9·10	82·8	7·56	57·2
50	9·61	92·4	9·10	82·8	8·66	75·1	7·21	52·0
55	9·19	84·5	8·70	75·8	8·29	68·8	6·92	47·8
60	8·83	78·0	8·36	70·0	7·97	63·6	6·66	44·4
65	8·51	72·4	8·06	65·0	7·69	59·1	6·43	41·4
70	8·22	67·7	7·80	60·8	7·44	55·3	6·23	38·9
75	7·97	63·6	7·56	57·2	7·21	52·0	6·03	36·4
80	7·74	60·0	7·34	54·0	7·01	49·2	5·81	33·7
85	7·53	56·8	7·15	51·1	6·83	46·6	5·61	31·4
90	7·34	54·0	6·97	48·6	6·66	44·4	5·43	29·5
95	7·17	51·4	6·81	46·4	6·51	42·3	5·28	27·8
100	7·01	49·2	6·66	44·4	6·36	40·5	5·13	26·3
105	6·86	47·1	6·52	42·5	6·23	38·9	5·01	25·1
110	6·72	45·2	6·39	40·9	6·11	37·3	4·89	23·9
115	6·60	43·5	6·27	39·3	5·95	35·4	4·78	22·9
120	6·48	42·0	6·16	38·0	5·81	33·7	4·69	21·9
125	6·36	40·5	6·03	36·4	5·67	32·2	4·60	21·1
130	6·26	39·2	5·89	34·7	5·55	30·8	4·51	20·4
135	6·16	38·0	5·76	33·2	5·43	29·5	4·44	19·7
140	6·05	36·6	5·65	31·9	5·33	28·4	4·37	19·0
145	5·92	35·1	5·53	30·6	5·23	27·3	4·30	18·5
150	5·81	33·7	5·43	29·5	5·13	26·3	4·24	17·9
155	5·70	32·5	5·34	28·5	5·05	25·5	4·18	17·5
160	5·60	31·3	5·25	27·5	4·97	24·7	4·13	17·0
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{15}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	20·96	439·5	19 78	391·3
20	...	...	...	...	19·16	367·2	18·19	331·1	17·17	295·0
25	...	...	20·91	437·5	17·17	295·0	16·31	266·1	15·40	237·2
30	19·78	391·3	19·16	367·2	15·71	246·8	14·92	222·7	14·09	198·6
35	18·33	336·2	17·76	315·6	14·57	212·4	13·84	191·7	13·08	171·1
40	17·17	295·0	16·64	276·9	13·66	186·6	12·98	168·5	12·26	150·5
45	16·21	262·8	15·71	246·8	12·90	166·5	12·26	150·5	11·59	134·4
50	15·40	237·2	14·92	222·7	12·26	150·5	11·66	136·0	11·02	121·6
55	14·70	216·1	14·25	203·0	11·72	137·3	11·14	124·2	10·54	111·0
60	14·09	198·6	13·66	186·6	11·24	126·4	10·69	114·3	10·11	102·3
65	13·55	183·8	13·14	172·7	10·82	117·1	10·29	106·0	9·74	94·9
70	13·08	171·1	12·68	160·8	10·45	109·2	9·94	98·8	9·41	88·5
75	12·65	160·1	12·26	150·5	10·11	102·3	9·62	92·7	9·11	83·0
80	12·26	150·5	11·89	141·4	9·81	96·3	9·34	87·2	8·84	78·2
85	11·91	142·0	11·55	133·5	9·54	91·0	9·08	82·5	8·60	74·0
90	11·59	134·4	11·24	126·4	9·28	86·2	8·84	78·2	8·38	70·2
95	11·30	127·6	10·95	120·0	9·05	82·0	8·62	74·4	8·17	66·8
100	11·02	121·6	10·69	114·3	8·84	78·2	8·42	71·0	7·98	63·8
105	10·77	116·0	10·45	109·2	8·65	74·8	8·24	67·9	7·81	61·0
110	10·54	111·0	10·22	104·5	8·46	71·6	8·07	65·1	7·65	58·5
115	10·32	106·5	10·01	100·2	8·29	68·8	7·90	62·5	7·50	56·2
120	10·11	102·3	9·81	96·3	8·13	66·2	7·75	60·1	7·36	54·1
125	9·92	98·4	9·62	92·7	7·98	63·8	7·61	58·0	7·22	52·2
130	9·74	94·9	9·45	89·3	7·84	61·5	7·48	56·0	7·10	50·4
135	9·57	91·6	9·28	86·2	7·71	59·5	7·36	54·1	6·98	48·8
140	9·41	88·5	9·13	83·4	7·59	57·6	7·24	52·4	6·87	47·2
145	9·25	85·7	...	...	7·47	55·8	7·13	50·8	6·77	45·8
150	9·11	83·0	...	...	7·36	54·1	7·02	49·3	6·67	44·5
155	...	...	...	...	7·25	52·6	6·92	47·9	6·58	43·2
160	...	...	...	...	7·15	51·1	6·83	46·6	6·49	42·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{15}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	20·96	439·5	19·90	396·1	16·31	266·1
15	18·19	331·1	17·17	295·0	16·31	266·1	13·39	179·4
20	15·80	249·8	14·92	222·7	14·18	201·0	11·66	136·0
25	14·18	201·0	13·39	179·4	12·73	162·0	10·49	110·0
30	12·98	168·5	12·26	150·5	11·66	136·0	9·62	92·7
35	12·05	145·3	11·39	129·8	10·83	117·4	8·96	80·3
40	11·31	127·9	10·69	114·3	10·17	103·5	8·42	71·0
45	10·69	114·3	10·11	102·3	9·62	92·7	7·98	63·8
50	10·17	103·5	9·62	92·7	9·16	84·0	7·61	58·0
55	9·73	94·6	9·21	84·8	8·77	76·9	7·30	53·2
60	9·34	87·2	8·84	78·2	8·42	71·0	7·02	49·3
65	9·00	81·0	8·52	72·6	8·12	66·0	6·78	46·0
70	8·69	75·6	8·24	67·9	7·85	61·7	6·57	43·1
75	8·42	71·0	7·98	63·8	7·61	58·0	6·37	40·6
80	8·18	66·9	7·75	60·1	7·40	54·7	6·20	38·5
85	7·96	63·3	7·55	57·0	7·20	51·9	6·02	36·2
90	7·75	60·1	7·36	54·1	7·02	49·3	5·82	33·8
95	7·57	57·3	7·18	51·6	6·86	47·0	5·64	31·8
100	7·40	54·7	7·02	49·3	6·71	45·0	5·48	30·0
105	7·24	52·4	6·87	47·2	6·57	43·1	5·34	28·5
110	7·09	50·3	6·73	45·4	6·44	41·4	5·20	27·1
115	6·95	48·4	6·61	43·6	6·31	39·9	5·08	25·8
120	6·83	46·6	6·49	42·1	6·20	38·5	4·97	24·7
125	6·71	45·0	6·37	40·6	6·09	37·1	4·87	23·7
130	6·59	43·5	6·27	39·3	5·95	35·4	4·78	22·8
135	6·49	42·1	6·17	38·1	5·82	33·8	4·69	22·0
140	6·39	40·8	6·06	36·7	5·70	32·5	4·61	21·3
145	6·29	39·6	5·93	35·2	5·58	31·2	4·54	20·6
150	6·20	38·5	5·82	33·8	5·48	30·0	4·47	20·0
155	6·12	37·4	5·71	32·6	5·38	29·0	4·40	19·4
160	6·00	36·0	5·61	31·4	5·29	28·0	4·34	18·8
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{1}{2}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	..	...	...	...	...
15	...	...	...	...	...	...	...	...	20·92	438·0
20	...	...	...	...	20·27	411·0	19·24	370·5	18·16	330·0
25	...	...	...	...	18·16	330·0	17·25	297·6	16·28	265·2
30	20·92	438·0	20·27	411·0	16·61	276·0	15·78	249·0	14·90	222·0
35	19·39	376·2	18·79	353·1	15·40	237·4	14·63	214·2	13·82	191·1
40	18·16	330·0	17·60	309·7	14·44	208·5	13·72	188·2	12·96	168·0
45	17·14	294·0	16·61	276·0	13·63	186·0	12·96	168·0	12·24	150·0
50	16·28	265·2	15·78	249·0	12·96	168·0	12·32	151·8	11·64	135·6
55	15·54	241·6	15·06	226·9	12·38	153·2	11·77	138·5	11·12	123·8
60	14·90	222·0	14·44	208·5	11·87	141·0	11·29	127·5	10·67	114·0
65	14·33	205·3	13·89	192·9	11·42	130·6	10·87	118·1	10·28	105·6
70	13·82	191·1	13·40	179·5	11·03	121·7	10·49	110·1	9·92	98·5
75	13·37	178·8	12·96	168·0	10·67	114·0	10·15	103·2	9·61	92·4
80	12·96	168·0	12·56	157·8	10·35	107·2	9·85	97·1	9·32	87·0
85	12·58	158·4	12·20	148·9	10·06	101·2	9·58	91·7	9·06	82·2
90	12·24	150·0	11·87	141·0	9·79	96·0	9·32	87·0	8·83	78·0
95	11·93	142·4	11·57	133·8	9·55	91·2	9·09	82·7	8·61	74·2
100	11·64	135·6	11·29	127·5	9·32	87·0	8·88	78·9	8·41	70·8
105	11·37	129·4	11·03	121·7	9·11	83·1	8·68	75·4	8·22	67·7
110	11·12	123·8	10·79	116·4	8·92	79·6	8·50	72·2	8·05	64·9
115	10·89	118·6	10·56	111·6	8·74	76·4	8·33	69·3	7·89	62·3
120	10·67	114·0	10·35	107·2	8·57	73·5	8·17	66·7	7·74	60·0
125	10·47	109·6	10·15	103·2	8·41	70·8	8·02	64·3	7·60	57·8
130	10·28	105·6	9·97	99·4	8·26	68·3	7·87	62·0	7·47	55·8
135	10·10	102·0	9·79	96·0	8·12	66·0	7·74	60·0	7·34	54·0
140	9·92	98·5	9·63	92·7	7·99	63·8	7·62	58·0	7·23	52·2
145	9·76	95·3	9·47	89·7	7·86	61·8	7·50	56·2	7·12	50·6
150	9·61	92·4	9·32	87·0	7·74	60·0	7·39	54·6	7·01	49·2
155	9·46	89·6	9·18	84·3	7·63	58·2	7·28	53·0	6·91	47·8
160	9·32	87·0	9·05	81·9	7·52	56·6	7·18	51·5	6·82	46·5
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{1}{2}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	17·25	297·6
15	19·24	370·5	18·16	330·0	17·25	297·6	14·15	200·4
20	16·71	279·3	15·78	249·0	14·99	224·7	12·32	151·8
25	14·99	224·7	14·15	200·4	13·45	180·9	11·07	122·6
30	13·72	188·2	12·96	168·0	12·32	151·8	10·15	103·2
35	12·73	162·2	12·03	144·8	11·44	130·9	9·45	89·3
40	11·94	142·6	11·29	127·5	10·74	115·3	8·88	78·9
45	11·29	127·5	10·67	114·0	10·15	103·2	8·41	70·8
50	10·74	115·3	10·15	103·2	9·66	93·4	8·02	64·3
55	10·26	105·4	9·71	94·3	9·24	85·5	7·68	59·0
60	9·85	97·1	9·32	87·0	8·88	78·9	7·39	54·6
65	9·49	90·1	8·98	80·7	8·56	73·2	7·13	50·8
70	9·17	84·1	8·68	75·4	8·27	68·4	6·90	47·6
75	8·88	78·9	8·41	70·8	8·02	64·3	6·70	44·8
80	8·62	74·3	8·17	66·7	7·79	60·6	6·51	42·4
85	8·38	70·3	7·94	63·1	7·58	57·4	6·34	40·3
90	8·17	66·7	7·74	60·0	7·39	54·6	6·19	38·4
95	7·97	63·5	7·56	57·1	7·21	52·0	6·03	36·3
100	7·79	60·6	7·39	54·6	7·05	49·7	5·85	34·2
105	7·62	58·0	7·23	52·2	6·90	47·6	5·69	32·3
110	7·46	55·7	7·08	50·1	6·76	45·7	5·54	30·7
115	7·31	53·5	6·94	48·2	6·63	44·0	5·40	29·2
120	7·18	51·5	6·82	46·5	6·51	42·4	5·28	27·9
125	7·05	49·7	6·70	44·8	6·40	40·9	5·17	26·7
130	6·93	48·0	6·58	43·3	6·29	39·6	5·06	25·6
135	6·82	46·5	6·48	42·0	6·19	38·4	4·97	24·7
140	6·71	45·0	6·38	40·7	6·09	37·1	4·88	23·8
145	6·61	43·7	6·28	39·5	5·96	35·6	4·79	23·0
150	6·51	42·4	6·19	38·4	5·85	34·2	4·71	22·2
155	6·42	41·2	6·10	37·3	5·74	32·9	4·64	21·5
160	6·33	40·1	5·99	35·9	5·64	31·7	4·57	20·9
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{17}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	20·30	412·1	19·15	367·0
25	...	...	...	...	19·15	367·0	18·19	330·9	17·17	294·8
30	...	...	...	...	17·51	306·8	16·63	276·7	15·70	246·6
35	20·46	418·5	19·81	392·7	16·24	263·8	15·25	238·0	14·57	212·2
40	19·15	367·0	18·56	344·4	15·22	231·6	14·45	209·0	13·65	186·5
45	18·08	326·8	17·51	306·8	14·37	206·5	13·65	186·5	12·90	166·4
50	17·17	294·8	16·63	276·7	13·65	186·5	12·97	168·4	12·26	150·4
55	16·38	268·5	15·87	252·1	13·04	170·0	12·39	153·6	11·71	137·2
60	15·70	246·6	15·22	231·6	12·50	156·4	11·89	141·3	11·24	126·3
65	15·10	228·1	14·63	214·2	12·03	144·8	11·44	130·9	10·82	117·0
70	14·57	212·2	14·12	199·3	11·61	134·9	11·04	122·0	10·44	109·1
75	14·09	198·5	13·65	186·5	11·24	126·3	10·69	114·3	10·11	102·2
80	13·65	186·5	13·23	175·2	10·90	118·8	10·37	107·5	9·81	96·2
85	13·26	175·8	12·85	165·2	10·59	112·1	10·07	101·5	9·53	90·9
90	12·90	166·4	12·50	156·4	10·31	106·2	9·81	96·2	9·28	86·2
95	12·57	158·0	12·18	148·5	10·05	101·0	9·56	91·5	9·05	82·0
100	12·26	150·4	11·89	141·3	9·81	96·2	9·34	87·2	8·84	78·2
105	11·98	143·5	11·61	134·9	9·59	91·9	9·13	83·3	8·64	74·7
110	11·71	137·2	11·36	129·0	9·38	88·0	8·93	79·8	8·46	71·6
115	11·47	131·5	11·12	123·7	9·19	84·4	8·75	76·6	8·29	68·7
120	11·24	126·3	10·90	118·8	9·01	81·2	8·58	73·6	8·13	66·1
125	11·02	121·5	10·69	114·3	8·84	78·2	8·42	70·9	7·98	63·7
130	10·82	117·0	10·49	110·1	8·68	75·4	8·27	68·4	7·84	61·5
135	10·62	112·9	10·31	106·2	8·53	72·8	8·13	66·1	7·71	59·4
140	10·44	109·1	10·13	102·6	8·39	70·4	8·00	64·0	7·58	57·5
145	10·27	105·5	9·96	99·3	8·26	68·2	7·87	62·0	7·47	55·7
150	10·11	102·2	9·81	96·2	8·13	66·1	7·75	60·1	7·35	54·1
155	9·57	99·1	9·66	93·3	8·01	64·2	7·64	58·4	7·25	52·5
160	9·81	96·2	9·51	90·6	7·90	62·4	7·53	56·7	7·15	51·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Table No. 11 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{17}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch.	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	18·19	330·9
15	20·30	412·1	19·15	367·0	18·19	330·9	14·92	222·6
20	17·62	310·5	16·63	276·7	15·80	249·6	12·97	168·4
25	15·80	249·6	14·92	222·6	14·17	200·9	11·66	135·9
30	14·45	209·0	13·65	186·5	12·97	168·4	10·69	114·3
35	13·41	180·0	12·67	160·7	12·05	145·2	9·94	98·8
40	12·58	158·2	11·89	141·3	11·30	127·8	9·34	87·2
45	11·89	141·3	11·24	126·3	10·69	114·3	8·84	78·2
50	11·30	127·8	10·69	114·3	10·17	103·4	8·42	70·9
55	10·80	116·7	10·22	104·4	9·72	94·6	8·06	65·0
60	10·37	107·5	9·81	96·2	9·34	87·2	7·75	60·1
65	9·98	99·7	9·45	89·3	8·99	80·9	7·48	55·9
70	9·64	93·0	9·13	83·3	8·69	75·6	7·24	52·4
75	9·34	87·2	8·84	78·2	8·42	70·9	7·02	49·3
80	9·06	82·1	8·58	73·6	8·18	66·9	6·82	46·6
85	8·81	77·6	8·34	69·7	7·95	63·3	6·65	44·2
90	8·58	73·6	8·13	66·1	7·75	60·1	6·48	42·1
95	8·37	70·1	7·93	63·0	7·57	57·3	6·34	40·2
100	8·18	66·9	7·75	60·1	7·39	54·7	6·20	38·4
105	8·00	64·0	7·58	57·5	7·24	52·4	6·06	36·7
110	7·83	61·3	7·43	55·2	7·09	50·3	5·89	34·7
115	7·68	58·9	7·28	53·0	6·95	48·3	5·74	33·0
120	7·53	56·7	7·15	51·1	6·82	46·6	5·60	31·4
125	7·39	54·7	7·02	49·3	6·70	44·9	5·48	30·0
130	7·27	52·8	6·90	47·6	6·59	43·4	5·36	28·7
135	7·15	51·1	6·79	46·1	6·48	42·1	5·25	27·6
140	7·03	49·5	6·68	44·6	6·38	40·8	5·15	26·5
145	6·93	48·0	6·58	43·3	6·29	39·6	5·06	25·6
150	6·82	46·6	6·48	42·1	6·20	38·4	4·97	24·7
155	6·73	45·3	6·39	40·9	6·11	37·4	4·89	23·9
160	6·63	44·0	6·31	39·8	6·00	36·0	4·82	23·2
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{9}{16}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	20·15	406·0
25	...	...	...	...	20·15	406·0	19·13	366·0	18·05	326·0
30	...	...	...	...	18·42	339·3	17·49	306·0	16·51	272·6
35	...	...	20·84	434·5	17·08	291·7	16·22	263·1	15·31	234·5
40	20·15	406·0	19·52	381·0	16·00	256·0	15·19	231·0	14·35	206·0
45	19·01	361·5	18·42	339·3	15·10	228·2	14·35	206·0	13·55	183·7
50	18·05	326·0	17·49	306·0	14·35	206·0	13·63	186·0	12·88	166·0
55	17·23	296·9	16·69	278·7	13·70	187·8	13·02	169·6	12·30	151·4
60	16·51	272·6	16·00	256·0	13·14	172·6	12·49	156·0	11·80	139·3
65	15·88	252·1	15·38	236·7	12·64	159·8	12·02	144·4	11·36	129·0
70	15·31	234·5	14·84	220·2	12·20	148·8	11·60	134·5	10·96	120·2
75	14·81	219·3	14·35	206·0	11·80	139·3	11·22	126·0	10·61	112·6
80	14·35	206·0	13·91	193·5	11·44	131·0	10·88	118·5	10·29	106·0
85	13·93	194·2	13·50	182·4	11·12	123·6	10·57	111·8	10·00	100·0
90	13·55	183·7	13·14	172·6	10·82	117·1	10·29	106·0	9·74	94·8
95	13·20	174·4	12·80	163·8	10·54	111·2	10·03	100·7	9·49	90·2
100	12·88	166·0	12·49	156·0	10·29	106·0	9·79	96·0	9·27	86·0
105	12·58	158·3	12·20	148·8	10·06	101·2	9·57	91·7	9·06	82·1
110	12·30	151·4	11·93	142·3	9·84	96·9	9·37	87·8	8·87	78·7
115	12·04	145·1	11·68	136·4	9·64	92·9	9·18	84·2	8·69	75·5
120	11·80	139·3	11·44	131·0	9·45	89·3	9·00	81·0	8·52	72·6
125	11·57	134·0	11·22	126·0	9·27	86·0	8·83	78·0	8·36	70·0
130	11·36	129·0	11·01	121·3	9·10	82·9	8·67	75·2	8·21	67·5
135	11·15	124·5	10·82	117·1	8·94	80·0	8·52	72·6	8·07	65·2
140	10·96	120·2	10·63	113·1	8·80	77·4	8·38	70·2	7·94	63·1
145	10·78	116·3	10·46	109·4	8·65	74·9	8·25	68·0	7·82	61·1
150	10·61	112·6	10·29	106·0	8·52	72·6	8·12	66·0	7·70	59·3
155	10·45	109·2	10·13	102·7	8·39	70·5	8·00	64·0	7·59	57·6
160	10·29	106·0	9·98	99·7	8·27	68·5	7·89	62·2	7·48	56·0
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 12 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{9}{16}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	19·13	366·0
15	...	...	20·15	406·0	19·13	366·0	15·68	246·0
20	18·53	343·5	17·49	306·0	16·61	276·0	13·63	186·0
25	16·61	276·0	15·68	246·0	14·90	222·0	12·24	150·0
30	15·19	231·0	14·35	206·0	13·63	186·0	11·22	126·0
35	14·10	198·8	13·32	177·4	12·66	160·2	10·43	108·8
40	13·22	174·7	12·49	156·0	11·87	141·0	9·79	96·0
45	12·49	156·0	11·80	139·3	11·22	126·0	9·27	86·0
50	11·87	141·0	11·22	126·0	10·67	114·0	8·83	78·0
55	11·34	128·7	10·72	115·0	10·20	104·1	8·45	71·4
60	10·88	118·5	10·29	106·0	9·79	96·0	8·12	66·0
65	10·48	109·8	9·91	98·3	9·43	89·0	7·83	61·3
70	10·12	102·4	9·57	91·7	9·11	83·1	7·57	57·4
75	9·79	96·0	9·27	86·0	8·83	78·0	7·34	54·0
80	9·50	90·3	9·00	81·0	8·57	73·5	7·14	51·0
85	9·24	85·4	8·75	76·5	8·33	69·5	6·95	48·3
90	9·00	81·0	8·52	72·6	8·12	66·0	6·78	46·0
95	8·77	77·0	8·31	69·1	7·92	62·8	6·62	43·8
100	8·57	73·5	8·12	66·0	7·74	60·0	6·48	42·0
105	8·38	70·2	7·94	63·1	7·57	57·4	6·34	40·2
110	8·20	67·3	7·78	60·5	7·42	55·0	6·22	38·7
115	8·04	64·6	7·62	58·1	7·27	52·9	6·10	37·2
120	7·89	62·2	7·48	56·0	7·14	51·0	5·95	35·4
125	7·74	60·0	7·34	54·0	7·01	49·2	5·81	33·7
130	7·61	57·9	7·22	52·1	6·89	47·5	5·68	32·2
135	7·48	56·0	7·10	50·4	6·78	46·0	5·56	30·9
140	7·36	54·2	6·99	48·8	6·67	44·5	5·45	29·7
145	7·25	52·5	6·88	47·3	6·57	43·2	5·34	28·5
150	7·14	51·0	6·78	46·0	6·48	42·0	5·25	27·5
155	7·04	49·5	6·68	44·7	6·39	40·8	5·16	26·6
160	6·94	48·1	6·59	43·5	6·30	39·7	5·07	25·7
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{19}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	20·07	402·9	18·94	358·8
30	...	...	...	...	19·32	373·5	18·35	336·7	17·32	300·0
35	...	...	...	...	17·91	321·0	17·01	289·5	16·06	258·0
40	...	...	20·48	419·4	16·78	281·6	15·94	254·0	15·05	226·5
45	19·95	398·0	19·32	373·5	15·84	251·0	15·05	226·5	14·21	202·0
50	18·94	358·8	18·35	336·7	15·05	226·5	14·29	204·4	13·50	182·4
55	18·07	326·7	17·51	306·6	14·36	206·4	13·65	186·4	12·89	166·3
60	17·32	300·0	16·78	281·6	13·77	189·7	13·09	171·3	12·37	153·0
65	16·65	277·3	16·13	260·4	13·25	175·6	12·59	158·6	11·90	141·6
70	16·06	258·0	15·56	242·2	12·78	163·5	12·15	147·7	11·49	132·0
75	15·53	241·2	15·05	226·5	12·37	153·0	11·76	138·3	11·11	123·6
80	15·05	226·5	14·58	212·7	11·99	143·8	11·40	130·0	10·78	116·2
85	14·61	213·5	14·16	200·5	11·65	135·7	11·07	122·7	10·47	109·7
90	14·21	202·0	13·77	189·7	11·33	128·5	10·78	116·2	10·19	104·0
95	13·84	191·6	13·42	180·0	11·04	122·0	10·51	110·4	9·94	98·8
100	13·50	182·4	13·09	171·3	10·78	116·2	10·25	105·2	9·70	94·2
105	13·19	174·0	12·78	163·5	10·53	111·0	10·02	100·5	9·48	90·0
110	12·89	166·3	12·50	156·3	10·30	106·2	9·80	96·2	9·28	86·1
115	12·62	159·3	12·24	149·8	10·09	101·8	9·60	92·2	9·09	82·6
120	12·37	153·0	11·99	143·8	9·89	97·8	9·41	88·6	8·91	79·5
125	12·13	147·1	11·76	138·3	9·70	94·2	9·24	85·3	8·75	76·5
130	11·90	141·6	11·54	133·2	9·53	90·8	9·07	82·3	8·59	73·8
135	11·69	136·6	11·33	128·5	9·36	87·6	8·91	79·5	8·44	71·3
140	11·49	132·0	11·14	124·1	9·20	84·7	8·76	76·8	8·30	69·0
145	11·29	127·6	10·95	120·0	9·05	82·0	8·62	74·4	8·17	66·8
150	11·11	123·6	10·78	116·2	8·91	79·5	8·49	72·1	8·05	64·8
155	10·94	119·8	10·61	112·6	8·78	77·1	8·36	70·0	7·93	62·9
160	10·78	116·2	10·45	109·3	8·65	74·9	8·24	68·0	7·81	61·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 13 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{19}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	20·07	402·9
15	...	...	...	...	20·07	402·9	16·45	270·6
20	19·44	378·0	18·35	336·7	17·42	303·6	14·29	204·4
25	17·42	303·6	16·45	270·6	15·62	244·1	12·83	164·7
30	15·94	254·0	15·05	226·5	14·29	204·4	11·76	138·3
35	14·78	218·6	13·96	195·0	13·27	176·1	10·92	119·4
40	13·85	192·0	13·09	171·3	12·44	154·8	10·25	105·2
45	13·09	171·3	12·37	153·0	11·76	138·3	9·70	94·2
50	12·44	154·8	11·76	138·3	11·18	125·0	9·24	85·3
55	11·88	141·3	11·23	126·2	10·68	114·2	8·84	78·1
60	11·40	130·0	10·78	116·2	10·25	105·2	8·49	72·1
65	10·97	120·4	10·38	107·7	9·87	97·5	8·19	67·0
70	10·59	112·3	10·02	100·5	9·54	91·0	7·91	62·7
75	10·25	105·2	9·70	94·2	9·24	85·3	7·67	58·9
80	9·95	99·0	9·41	88·6	8·96	80·4	7·45	55·6
85	9·67	93·5	9·15	83·8	8·72	76·0	7·25	52·6
90	9·41	88·6	8·91	79·5	8·49	72·1	7·07	50·1
95	9·18	84·3	8·69	75·6	8·28	68·6	6·91	47·7
100	8·96	80·4	8·49	72·1	8·09	65·5	6·76	45·6
105	8·76	76·8	8·30	69·0	7·91	62·7	6·61	43·8
110	8·58	73·6	8·13	66·1	7·75	60·1	6·48	42·0
115	8·41	70·7	7·97	63·5	7·60	57·7	6·36	40·5
120	8·24	68·0	7·81	61·1	7·45	55·6	6·25	39·0
125	8·09	65·5	7·67	58·9	7·32	53·6	6·14	37·7
130	7·95	63·2	7·54	56·8	7·19	51·7	6·01	36·1
135	7·81	61·1	7·41	55·0	7·07	50·1	5·88	34·5
140	7·69	59·1	7·29	53·2	6·96	48·5	5·75	33·1
145	7·57	57·3	7·18	51·6	6·86	47·0	5·64	31·8
150	7·45	55·6	7·07	50·1	6·76	45·6	5·53	30·6
155	7·35	54·0	6·97	48·6	6·66	44·4	5·43	29·5
160	7·24	52·5	6·88	47·3	6·57	43·2	5·34	28·5
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces

Iron Plate $\frac{5}{8}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	19·83	393·2
30	...	...	...	...	20·23	409·3	19·21	369·0	18·13	328·6
35	...	...	...	...	18·75	351·7	17·80	317·1	16·81	282·5
40	...	...	...	...	17·56	308·5	16·68	278·2	15·74	248·0
45	20·88	436·2	20·23	409·3	16·58	274·8	15·74	248·0	14·87	221·1
50	19·83	393·2	19·21	369·0	15·74	248·0	14·96	223·8	14·12	199·6
55	18·92	358·0	18·33	336·0	15·03	226·0	14·28	204·0	13·49	182·0
60	18·13	328·6	17·56	308·5	14·41	207·6	13·69	187·5	12·93	167·3
65	17·43	303·8	16·88	285·2	13·86	192·1	13·17	173·5	12·44	154·9
70	16·81	282·5	16·28	265·2	13·37	178·8	12·71	161·5	12·01	144·2
75	16·25	264·1	15·74	248·0	12·93	167·3	12·29	151·2	11·62	135·0
80	15·74	248·0	15·26	232·8	12·54	157·2	11·92	142·1	11·27	127·0
85	15·29	233·7	14·81	219·5	12·18	148·3	11·58	134·1	10·95	119·8
90	14·87	221·1	14·41	207·6	11·85	140·4	11·27	127·0	10·65	113·5
95	14·48	209·7	14·03	197·0	11·54	133·3	10·98	120·6	10·38	107·8
100	14·12	199·6	13·69	187·5	11·27	127·0	10·72	114·9	10·14	102·8
105	13·79	190·3	13·37	178·8	11·01	121·2	10·47	109·7	9·91	98·1
110	13·49	182·0	13·07	171·0	10·77	116·0	10·24	105·0	9·69	94·0
115	13·20	174·3	12·80	163·8	10·54	111·2	10·03	100·6	9·49	90·1
120	12·93	167·3	12·54	157·2	10·33	106·8	9·83	96·7	9·31	86·6
125	12·68	160·8	12·29	151·2	10·14	102·8	9·65	93·1	9·13	83·4
130	12·44	154·9	12·06	145·6	9·95	99·0	9·47	89·7	8·97	80·4
135	12·22	149·4	11·85	140·4	9·78	95·6	9·31	86·6	8·81	77·7
140	12·01	144·2	11·64	135·6	9·61	92·4	9·15	83·7	8·66	75·1
145	11·81	139·5	11·45	131·1	9·45	89·4	9·00	81·0	8·53	72·7
150	11·62	135·0	11·27	127·0	9·31	86·6	8·86	78·6	8·39	70·5
155	11·44	130·9	11·09	123·0	9·16	84·0	8·73	76·2	8·27	68·4
160	11·27	127·0	10·92	119·4	9·03	81·6	8·60	74·0	8·15	66·5
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{5}{8}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	17·21	296·4
20	20·35	414·3	19·21	369·0	18·24	332·7	14·96	223·8
25	18·24	332·7	17·21	296·4	16·35	267·3	13·42	180·2
30	16·68	278·2	15·74	248·0	14·96	223·8	12·29	151·2
35	15·47	239·3	14·61	213·4	13·88	192·6	11·42	130·4
40	14·49	210·1	13·69	187·5	13·01	169·3	10·72	114·9
45	13·69	187·5	12·93	167·3	12·29	151·2	10·13	102·8
50	13·01	169·3	12·29	151·2	11·69	136·6	9·65	93·1
55	12·43	154·5	11·74	138·0	11·17	124·8	9·23	85·2
60	11·92	142·1	11·27	127·0	10·72	114·9	8·86	78·6
65	11·47	131·6	10·84	117·6	10·32	106·5	8·54	73·0
70	11·07	122·6	10·47	109·7	9·96	99·3	8·26	68·2
75	10·72	114·9	10·13	102·8	9·65	93·1	8·00	64·0
80	10·39	108·0	9·83	96·7	9·36	87·6	7·77	60·4
85	10·10	102·0	9·56	91·4	9·10	82·8	7·56	57·2
90	9·83	96·7	9·31	86·6	8·86	78·6	7·37	54·4
95	9·59	91·9	9·07	82·4	8·64	74·7	7·20	51·8
100	9·36	87·6	8·86	78·6	8·44	71·3	7·04	49·5
105	9·15	83·7	8·66	75·1	8·26	68·2	6·89	47·4
110	8·95	80·2	8·48	72·0	8·08	65·4	6·75	45·6
115	8·77	77·0	8·31	69·1	7·92	62·8	6·62	43·8
120	8·60	74·0	8·15	66·5	7·77	60·4	6·50	42·3
125	8·44	71·3	8·00	64·0	7·63	58·2	6·39	40·8
130	8·29	68·8	7·86	61·8	7·50	56·2	6·28	39·5
135	8·15	66·5	7·73	59·7	7·37	54·4	6·18	38·2
140	8·02	64·3	7·60	57·8	7·25	52·6	6·08	36·9
145	7·89	62·3	7·48	56·0	7·14	51·0	5·95	35·4
150	7·77	60·4	7·37	54·4	7·04	49·5	5·83	34·0
155	7·66	58·6	7·27	52·8	6·94	48·1	5·72	32·8
160	7·55	57·0	7·16	51·3	6·84	46·8	5·62	31·6
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{21}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	20·71	429·2
30	...	...	...	...	...	...	20·06	402·7	18·93	358·6
35	...	...	...	...	19·59	383·8	18·60	346·0	17·55	308·2
40	...	...	...	...	18·34	336·6	17·42	303·5	16·44	270·5
45	...	...	...	...	17·31	299·8	16·44	270·5	15·52	241·1
50	20·71	429·2	20·06	402·7	16·44	270·5	15·62	244·0	14·75	217·6
55	19·76	390·7	19·14	366·6	15·69	246·4	14·91	222·4	14·08	198·3
60	18·93	358·6	18·34	336·6	15·04	226·4	14·29	204·3	13·50	182·3
65	18·20	331·5	17·64	311·1	14·47	209·4	13·75	189·1	12·99	168·7
70	17·55	308·2	17·01	289·3	13·96	194·9	13·26	176·0	12·53	157·1
75	16·97	288·1	16·44	270·5	13·50	182·3	12·83	164·7	12·12	147·0
80	16·44	270·5	15·93	253·9	13·08	171·3	12·44	154·7	11·75	138·2
85	15·96	254·9	15·47	239·3	12·71	161·5	12·08	146·0	11·42	130·4
90	15·52	241·1	15·04	226·4	12·36	152·9	11·75	138·2	11·11	123·5
95	15·12	228·7	14·65	214·8	12·05	145·2	11·45	131·2	10·83	117·3
100	14·75	217·6	14·29	204·3	11·75	138·2	11·18	125·0	10·57	111·8
105	14·40	207·5	13·96	194·9	11·48	131·9	10·92	119·3	10·33	106·7
110	14·08	198·3	13·65	186·3	11·23	126·2	10·68	114·2	10·10	102·1
115	13·78	190·0	13·36	178·5	11·00	121·0	10·46	109·5	9·90	98·0
120	13·50	182·3	13·08	171·3	10·78	116·2	10·25	105·1	9·70	94·1
125	13·24	175·2	12·83	164·7	10·57	111·8	10·06	101·2	9·52	90·6
130	12·99	168·7	12·59	158·5	10·38	107·7	9·87	97·5	9·34	87·3
135	12·75	162·7	12·36	152·9	10·19	103·9	9·70	94·1	9·18	84·3
140	12·53	157·1	12·15	147·6	10·02	100·4	9·54	91·0	9·03	81·5
145	12·32	151·9	11·95	142·8	9·86	97·2	9·38	88·0	8·88	78·9
150	12·12	147·0	11·75	138·2	9·70	94·1	9·23	85·3	8·74	76·5
155	11·93	142·5	11·57	133·9	9·55	91·3	9·09	82·7	8·61	74·2
160	11·75	138·2	11·40	129·9	9·41	88·6	8·96	80·3	8·49	72·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 15 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{21}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	17·98	323·4
20	...	...	20·06	402·7	19·05	363·0	15·62	244·0
25	19·05	363·0	17·98	323·4	17·07	291·6	14·01	196·4
30	17·42	303·5	16·44	270·5	15·62	244·0	12·83	164·7
35	16·15	261·0	15·25	232·7	14·49	210·0	11·91	142·0
40	15·13	229·1	14·29	204·3	13·58	184·5	11·18	125·0
45	14·29	204·3	13·50	182·3	12·83	164·7	10·57	111·8
50	13·58	184·5	12·83	164·7	12·20	148·8	10·06	101·2
55	12·97	168·3	12·25	150·2	11·65	135·8	9·62	92·5
60	12·44	154·7	11·75	138·2	11·18	125·0	9·23	85·3
65	11·97	143·3	11·31	128·0	10·76	115·8	8·90	79·2
70	11·55	133·5	10·92	119·3	10·39	108·0	8·60	74·0
75	11·18	125·0	10·57	111·8	10·06	101·2	8·33	69·4
80	10·84	117·5	10·25	105·1	9·76	95·2	8·09	65·5
85	10·53	111·0	9·96	99·3	9·48	90·0	7·87	62·0
90	10·25	105·1	9·70	94·1	9·23	85·3	7·67	58·9
95	9·99	99·9	9·46	89·5	9·01	81·1	7·49	56·1
100	9·76	95·2	9·23	85·3	8·79	77·4	7·32	53·6
105	9·54	91·0	9·03	81·5	8·60	74·0	7·16	51·3
110	9·33	87·1	8·84	78·1	8·42	70·9	7·02	49·2
115	9·14	83·6	8·66	75·0	8·25	68·1	6·88	47·4
120	8·96	80·3	8·49	72·1	8·09	65·5	6·75	45·6
125	8·79	77·4	8·33	69·4	7·94	63·1	6·64	44·0
130	8·64	74·6	8·18	67·0	7·80	60·9	6·52	42·6
135	8·49	72·1	8·04	64·7	7·67	58·9	6·42	41·2
140	8·35	69·7	7·91	62·6	7·55	57·0	6·32	40·0
145	8·22	67·5	7·79	60·7	7·43	55·2	6·23	38·8
150	8·09	65·5	7·67	58·9	7·32	53·6	6·14	37·7
155	7·97	63·5	7·56	57·1	7·21	52·0	6·03	36·3
160	7·86	61·7	7·45	55·5	7·11	50·6	5·92	35·0
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{11}{16}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	..	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	20·92	438·0	19·74	390·0
35	...	...	...	...	20·43	417·4	19·39	376·2	18·30	335·1
40	...	...	...	...	19·13	366·0	18·16	330·0	17·14	294·0
45	...	...	...	...	18·05	326·0	17·14	294·0	16·18	262·0
50	...	...	20·92	438·0	17·14	294·0	16·28	265·2	15·37	236·4
55	20·61	424·9	19·96	398·7	16·36	267·8	15·54	241·6	14·67	215·4
60	19·74	390·0	19·13	366·0	15·68	246·0	14·90	222·0	14·07	198·0
65	18·98	360·4	18·39	338·3	15·08	227·5	14·33	205·3	13·53	183·2
70	18·30	335·1	17·73	314·5	14·55	211·7	13·82	191·1	13·06	170·5
75	17·69	313·2	17·14	294·0	14·07	198·0	13·37	178·8	12·63	159·6
80	17·14	294·0	16·61	276·0	13·63	186·0	12·96	168·0	12·24	150·0
85	16·64	277·0	16·12	260·1	13·24	175·4	12·58	158·4	11·89	141·5
90	16·18	262·0	15·68	246·0	12·88	166·0	12·24	150·0	11·57	134·0
95	15·76	248·5	15·27	233·3	12·55	157·5	11·93	142·4	11·28	127·2
100	15·37	236·4	14·90	222·0	12·24	150·0	11·64	135·6	11·01	121·2
105	15·01	225·4	14·55	211·7	11·96	143·1	11·37	129·4	10·75	115·7
110	14·67	215·4	14·22	202·3	11·70	136·9	11·12	123·8	10·52	110·7
115	14·36	206·3	13·92	193·8	11·45	131·2	10·89	118·6	10·30	106·1
120	14·07	198·0	13·63	186·0	11·22	126·0	10·67	114·0	10·10	102·0
125	13·79	190·3	13·37	178·8	11·01	121·2	10·47	109·6	9·90	98·1
130	13·53	183·2	13·12	172·1	10·80	116·7	10·28	105·6	9·72	94·6
135	13·29	176·6	12·88	166·0	10·61	112·6	10·10	102·0	9·55	91·3
140	13·06	170·5	12·66	160·2	10·43	108·8	9·92	98·5	9·39	88·2
145	12·84	164·8	12·44	154·9	10·26	105·3	9·76	95·3	9·24	85·4
150	12·63	159·6	12·24	150·0	10·10	102·0	9·61	92·4	9·10	82·8
155	12·43	154·6	12·05	145·3	9·94	98·9	9·46	89·6	8·96	80·3
160	12·24	150·0	11·87	141·0	9·79	96·0	9·32	87·0	8·83	78·0
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Table No. 16 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{11}{16}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	18·75	351·6
20	...	...	20·92	438·0	19·87	394·8	16·28	265·2
25	19·87	394·8	18·75	351·6	17·80	317·0	14·60	213·3
30	18·16	330·0	17·14	294·0	16·28	265·2	13·37	178·8
35	16·84	283·7	15·90	252·8	15·10	228·1	12·41	154·1
40	15·78	249·0	14·90	222·0	14·15	200·4	11·64	135·6
45	14·90	222·0	14·07	198·0	13·37	178·8	11·01	121·2
50	14·15	200·4	13·37	178·8	12·71	161·5	10·47	109·6
55	13·51	182·7	12·77	163·0	12·14	147·3	10·01	100·2
60	12·96	168·0	12·24	150·0	11·64	135·6	9·61	92·4
65	12·47	155·5	11·78	138·9	11·20	125·6	9·26	85·7
70	12·03	144·8	11·37	129·4	10·82	117·0	8·94	80·0
75	11·64	135·6	11·01	121·2	10·47	109·6	8·66	75·1
80	11·29	127·5	10·67	114·0	10·15	103·2	8·41	70·8
85	10·97	120·3	10·37	107·6	9·87	97·4	8·18	66·9
90	10·67	114·0	10·10	102·0	9·61	92·4	7·97	63·6
95	10·40	108·3	9·84	96·9	9·37	87·8	7·78	60·5
100	10·15	103·2	9·61	92·4	9·15	83·7	7·60	57·8
105	9·92	98·5	9·39	88·2	8·94	80·0	7·44	55·3
110	9·71	94·3	9·19	84·5	8·75	76·6	7·28	53·1
115	9·51	90·5	9·00	81·0	8·58	73·6	7·14	51·0
120	9·32	87·0	8·83	78·0	8·41	70·8	7·01	49·2
125	9·15	83·7	8·66	75·1	8·25	68·2	6·89	47·4
130	8·98	80·7	8·51	72·4	8·11	65·8	6·77	45·8
135	8·83	78·0	8·36	70·0	7·97	63·6	6·66	44·4
140	8·68	75·4	8·22	67·7	7·84	61·5	6·56	43·0
145	8·54	73·0	8·09	65·5	7·72	59·6	6·46	41·7
150	8·41	70·8	7·97	63·6	7·60	57·8	6·36	40·5
155	8·29	68·7	7·85	61·7	7·49	56·1	6·28	39·4
160	8·17	66·7	7·74	60·0	7·39	54·6	6·19	38·4
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{23}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	20·55	422·6
35	...	...	...	...	...	...	20·19	407·7	19·05	363·1
40	...	...	...	...	19·91	396·6	18·91	357·5	17·84	318·5
45	...	...	...	...	18·79	353·2	17·84	318·5	16·84	283·7
50	...	...	...	...	17·84	318·5	16·94	287·2	16·00	256·0
55	...	...	20·78	432·1	17·03	290·0	16·17	261·6	15·27	233·2
60	20·55	422·6	19·91	396·6	16·32	266·4	15·50	240·3	14·64	214·3
65	19·76	390·6	19·14	366·5	15·69	246·3	14·91	222·3	14·08	198·3
70	19·05	363·1	18·46	340·8	15·14	229·2	14·38	206·8	13·58	184·5
75	18·42	339·3	17·84	318·5	14·64	214·3	13·91	193·5	13·14	172·6
80	17·84	318·5	17·29	298·9	14·18	201·3	13·48	181·7	12·73	162·2
85	17·32	300·1	16·78	281·7	13·77	189·8	13·09	171·4	12·37	153·0
90	16·84	283·7	16·32	266·4	13·40	179·6	12·73	162·2	12·03	144·8
95	16·40	269·1	15·89	252·7	13·05	170·4	12·41	154·0	11·73	137·5
100	16·00	256·0	15·50	240·3	12·73	162·2	12·10	146·6	11·44	131·0
105	15·62	244·0	15·14	229·2	12·44	154·8	11·83	139·9	11·18	125·0
110	15·27	233·2	14·80	219·0	12·16	148·0	11·56	133·8	10·93	119·6
115	14·94	223·3	14·48	209·8	11·91	141·8	11·32	128·2	10·71	114·6
120	14·64	214·3	14·18	201·3	11·67	136·2	11·09	123·1	10·49	110·1
125	14·35	206·0	13·91	193·5	11·44	131·0	10·88	118·5	10·29	106·0
130	14·08	198·3	13·64	186·2	11·23	126·1	10·68	114·1	10·10	102·1
135	13·82	191·1	13·40	179·6	11·03	121·7	10·49	110·1	9·93	98·5
140	13·58	184·5	13·16	173·4	10·84	117·6	10·31	106·4	9·76	95·2
145	13·35	178·4	12·94	167·6	10·66	113·7	10·14	102·9	9·60	92·2
150	13·14	172·6	12·73	162·2	10·49	110·1	9·98	99·7	9·45	89·3
155	12·93	167·2	12·53	157·2	10·33	106·8	9·83	96·7	9·30	86·6
160	12·73	162·2	12·34	152·4	10·18	103·6	9·69	93·8	9·17	84·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 17 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{23}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	19·52	381·0
20	...	...	...	...	20·68	427·8	16·94	287·2
25	20·68	427·8	19·52	381·0	18·53	343·5	15·19	231·0
30	18·91	357·5	17·84	318·5	16·94	287·2	13·91	193·5
35	17·53	307·3	16·54	273·8	15·71	247·0	12·91	166·7
40	16·42	269·6	15·50	240·3	14·72	216·9	12·10	146·6
45	15·50	240·3	14·64	214·3	13·91	193·5	11·44	131·0
50	14·72	216·9	13·91	193·5	13·22	174·7	10·88	118·5
55	14·06	197·7	13·28	176·4	12·62	159·4	10·40	108·2
60	13·48	181·7	12·73	162·2	12·10	146·6	9·98	99·7
65	12·97	168·2	12·25	150·2	11·65	135·8	9·62	92·5
70	12·51	156·6	11·83	139 9	11·24	126·5	9·29	86·3
75	12·10	146·6	11·44	131·0	10·88	118·5	9·00	81·0
80	11·74	137·8	11·09	123·1	10·55	111·4	8·73	76·3
85	11·40	130·0	10·78	116·2	10·26	105·2	8·49	72·1
90	11·09	123·1	10·49	110·1	9·98	99·7	8·27	68·5
95	10·81	117·0	10·23	104·6	9·73	94·8	8·07	65·2
100	10·55	111·4	9·98	99·7	9·50	90·3	7·89	62·2
105	10·31	106·4	9·76	95·2	9·29	86·3	7·71	59·5
110	10·09	101·8	9·55	91·2	9·09	82·7	7·55	57·1
115	9·88	97·7	9·35	87·5	8·90	79·3	7·41	54·9
120	9·69	93·8	9·17	84·1	8·73	76·3	7·27	52·8
125	9·50	90·3	9·00	81·0	8·57	73·5	7·14	51·0
130	9·33	87·1	8·83	78·1	8·42	70·9	7·02	49·2
135	9·17	84·1	8·68	75·4	8·27	68·5	6·90	47·6
140	9·01	81·3	8·54	72·9	8·14	66·2	6·79	46·1
145	8·87	78·7	8·40	70·6	8·01	64·1	6·69	44·7
150	8·73	76·3	8·27	68·5	7·89	62·2	6·59	43·5
155	8·60	74·0	8·15	66·4	7·77	60·4	6·50	42·2
160	8·48	71·9	8·03	64·5	7·66	58·7	6·41	41·1
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{3}{4}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	..	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	..	...	...	...	...	...	...
35	...	...	...	...	...	...	20·99	440·5	19·80	392·2
40	...	...	...	...	20·70	428·5	19·65	386·2	18·54	344·0
45	...	...	...	...	19·53	381·5	18·54	344·0	17·50	306·4
50	..	...	...	...	18·54	344·0	17·61	310·2	16·62	276·4
55	...	...	...	...	17·70	313·2	16·81	282·5	15·86	251·8
60	...	...	20·70	428·5	16·96	287·6	16·10	259·5	15·21	231·3
65	20·54	422·0	19·90	396·0	16·31	266·0	15·49	240·0	14·62	214·0
70	19·80	392·2	19·18	368·1	15·73	247·4	14·94	223·2	14·11	199·1
75	19·14	366·5	18·54	344·0	15·21	231·3	14·45	208·8	13·64	186·2
80	18·54	344·0	17·96	322·8	14·74	217·2	14·00	196·1	13·22	175·0
85	18·00	324·1	17·44	304·2	14·31	204·8	13·60	184·9	12·84	165·0
90	17·50	306·4	16·96	287·6	13·92	193·7	13·22	175·0	12·49	156·2
95	17·04	290·6	16·51	272·8	13·56	183·8	12·88	166·1	12·17	148·3
100	16·62	276·4	16·11	259·5	13·22	175·0	12·57	158·1	11·88	141·2
105	16·23	263·5	15·73	247·4	12·92	166·9	12·28	150·8	11·60	134·7
110	15·86	251·8	15·37	236·4	12·63	159·6	12·01	144·2	11·35	128·9
115	15·52	241·1	15·04	226·4	12·36	152·9	11·75	138·2	11·11	123·5
120	15·21	231·3	14·74	217·2	12·11	146·8	11·52	132·7	10·89	118·6
125	14·91	222·3	14·45	208·8	11·88	141·2	11·30	127·6	10·68	114·1
130	14·62	214·0	14·17	201·0	11·66	136·0	11·09	123·0	10·48	110·0
135	14·36	206·2	13·92	193·7	11·45	131·1	10·89	118·6	10·30	106·1
140	14·11	199·1	13·67	187·0	11·25	126·7	10·70	114·6	10·12	102·5
145	13·87	192·4	13·44	180·8	11·07	122·5	10·53	110·8	9·96	99·2
150	13·64	186·2	13·22	175·0	10·89	118·6	10·36	107·4	9·80	96·1
155	13·43	180·4	13·02	169·5	10·72	115·0	10·20	104·1	9·65	93·2
160	13·22	175·0	12·82	164·4	10·56	111·6	10·05	101·0	9·51	90·5
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{3}{4}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	20·28	411·6
20	...	...	...	...	...	...	17·61	310·2
25	...	...	20·28	411·6	19·26	371·0	15·79	249·3
30	19·65	386·2	18·54	344·0	17·61	310·2	14·45	208·8
35	18·21	331·9	17·19	295·7	16·33	266·7	13·41	179·8
40	17·06	291·1	16·11	259·5	15·30	234·1	12·57	158·1
45	16·10	259·5	15·21	231·3	14·45	208·8	11·88	141·2
50	15·30	234·1	14·45	208·8	13·73	188·5	11·30	127·6
55	14·60	213·4	13·79	190·3	13·11	171·9	10·79	116·6
60	14·00	196·1	13·22	175·0	12·57	158·1	10·36	107·4
65	13·47	181·5	12·72	162·0	12·10	146·4	9·98	99·6
70	12·99	168·9	12·28	150·8	11·67	136·3	9·64	92·9
75	12·57	158·1	11·88	141·2	11·30	127·6	9·33	87·1
80	12·19	148·5	11·52	132·7	10·95	120·0	9·05	82·0
85	11·84	140·2	11·19	125·2	10·64	113·3	8·80	77·5
90	11·52	132·7	10·89	118·6	10·36	107·4	8·58	73·6
95	11·22	126·0	10·61	112·7	10·10	102·0	8·37	70·0
100	10·95	120·0	10·36	107·4	9·86	97·2	8·17	66·8
105	10·70	114·6	10·12	102·5	9·64	92·9	7·99	63·9
110	10·47	109·7	9·90	98·1	9·43	88·9	7·83	61·3
115	10·25	105·1	9·70	94·1	9·23	85·3	7·67	58·9
120	10·05	101·0	9·51	90·5	9·05	82·0	7·53	56·7
125	9·86	97·2	9·33	87·1	8·88	79·0	7·39	54·6
130	9·68	93·7	9·16	84·0	8·73	76·2	7·26	52·8
135	9·51	90·5	9·00	81·0	8·58	73·6	7·14	51·0
140	9·35	87·4	8·85	78·4	8·43	71·1	7·03	49·4
145	9·20	84·6	8·71	75·9	8·30	68·9	6·92	47·9
150	9·05	82·0	8·58	73·6	8·17	66·8	6·82	46·5
155	8·92	79·5	8·45	71·4	8·05	64·8	6·72	45·2
160	8·79	77·2	8·33	69·3	7·94	63·0	6·63	44·0
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{25}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	20·55	422·5
40	...	...	...	...	...	...	20·39	416·0	19·24	370·5
45	...	...	...	...	20·27	411·0	19·24	370·5	18·16	330·0
50	...	...	...	...	19·24	370·5	18·27	334·0	17·25	297·6
55	...	...	...	...	18·36	337·3	17·44	304·2	16·46	271·0
60	...	...	...	...	17·60	309·7	16·71	279·3	15·78	249·0
65	...	...	20·65	426·5	16·92	286·3	16·07	258·3	15·17	230·3
70	20·55	422·5	19·91	396·5	16·32	266·3	15·50	240·3	14·63	214·2
75	19·87	394·8	19·24	370·5	15·78	249·0	14·99	224·7	14·15	200·4
80	19·24	370·5	18·64	347·7	15·29	233·8	14·52	211·0	13·72	188·2
85	18·68	349·0	18·10	327·6	14·84	220·4	14·10	198·9	13·32	177·5
90	18·16	330·0	17·60	309·7	14·44	208·5	13·72	188·2	12·96	168·0
95	17·69	312·9	17·14	293·7	14·06	197·8	13·36	178·6	12·62	159·4
100	17·25	297·6	16·71	279·3	13·72	188·2	13·04	170·0	12·32	151·8
105	16·84	283·7	16·32	266·3	13·40	179·5	12·73	162·2	12·03	144·8
110	16·46	271·0	15·95	254·5	13·10	171·6	12·45	155·1	11·77	138·5
115	16·11	259·5	15·61	243·7	12·82	164·4	12·19	148·6	11·52	132·7
120	15·78	249·0	15·29	233·8	12·56	157·8	11·94	142·6	11·29	127·5
125	15·46	239·2	14·99	224·7	12·32	151·8	11·71	137·2	11·07	122·6
130	15·17	230·3	14·70	216·2	12·09	146·1	11·49	132·1	10·87	118·1
135	14·90	222·0	14·44	208·5	11·87	141·0	11·29	127·5	10·67	114·0
140	14·63	214·2	14·18	201·2	11·67	136·1	11·09	123·1	10·49	110·1
145	14·39	207·1	13·94	194·5	11·47	131·6	10·91	119·1	10·32	106·5
150	14·15	200·4	13·72	188·2	11·29	127·5	10·74	115·3	10·15	103·2
155	13·93	194·1	13·50	182·3	11·11	123·5	10·57	111·8	10·00	100·0
160	13·72	188·2	13·29	176·8	10·95	119·9	10·41	108·5	9·85	97·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Table No. 19 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{25}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	18·27	334·0
25	...	...	...	...	19·99	399·6	16·38	268·4
30	20·39	416·0	19·24	370·5	18·27	334·0	14·99	224·7
35	18·90	357·4	17·84	318·4	16·94	287·1	13·90	193·4
40	17·70	313·5	16·71	279·3	15·87	252·0	13·04	170·0
45	16·71	279·3	15·78	249·0	14·99	224·7	12·32	151·8
50	15·87	252·0	14·99	224·7	14·24	202·8	11·71	137·2
55	15·15	229·6	14·31	204·8	13·60	184·9	11·19	125·2
60	14·52	211·0	13·72	188·2	13·04	170·0	10·74	115·3
65	13·97	195·2	13·20	174·2	12·54	157·4	10·34	106·9
70	13·48	181·7	12·73	162·2	12·10	146·5	9·98	99·7
75	13·04	170·0	12·32	151·8	11·71	137·2	9·66	93·4
80	12·64	159·7	11·94	142·6	11·35	129·0	9·38	88·0
85	12·27	150·7	11·60	134·6	11·03	121·7	9·12	83·1
90	11·94	142·6	11·29	127·5	10·74	115·3	8·88	78·9
95	11·64	135·4	11·00	121·1	10·46	109·5	8·66	75·0
100	11·35	129·0	10·74	115·3	10·21	104·4	8·46	71·6
105	11·09	123·1	10·49	110·1	9·98	99·7	8·27	68·4
110	10·85	117·8	10·26	105·4	9·77	95·4	8·10	65·6
115	10·62	112·9	10·05	101·0	9·57	91·5	7·94	63·0
120	10·41	108·5	9·85	97·1	9·38	88·0	7·79	60·6
125	10·21	104·4	9·66	93·4	9·20	84·7	7·64	58·4
130	10·03	100·6	9·49	90·1	9·04	81·7	7·51	56·4
135	9·85	97·1	9·32	87·0	8·88	78·9	7·39	54·6
140	9·68	93·8	9·17	84·1	8·73	76·2	7·27	52·8
145	9·53	90·8	9·02	81·4	8·59	73·8	7·15	51·2
150	9·38	88·0	8·88	78·9	8·46	71·6	7·05	49·7
155	9·24	85·3	8·75	76·5	8·33	69·4	6·95	48·3
160	9·10	82·8	8·62	74·3	8·21	67·5	6·85	47·0
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{13}{16}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	19·95	398·0
45	...	...	...	...	...	...	19·95	398·0	18·82	354·4
50	...	...	...	...	19·95	398·0	18·94	358·8	17·87	319·6
55	...	...	...	...	19·03	362·3	18·07	326·7	17·06	291·0
60	...	...	...	...	18·24	332·6	17·32	300·0	16·35	267·3
65	...	...	...	...	17·53	307·5	16·65	277·3	15·72	247·2
70	...	...	20·64	426·0	16·91	286·0	16·06	258·0	15·16	230·0
75	20·59	424·1	19·95	398·0	16·35	267·3	15·53	241·2	14·66	215·0
80	19·95	398·0	19·32	373·5	15·84	251·0	15·05	226·5	14·21	202·0
85	19·36	374·9	18·75	351·8	15·38	236·5	14·61	213·5	13·80	190·4
90	18·82	354·4	18·24	332·6	14·96	223·7	14·21	202·0	13·42	180·2
95	18·33	336·1	17·76	315·4	14·57	212·3	13·84	191·6	13·07	171·0
100	17·87	319·6	17·32	300·0	14·21	202·0	13·50	182·4	12·76	162·8
105	17·45	304·6	16·91	286·0	13·88	192·6	13·19	174·0	12·46	155·3
110	17·06	291·0	16·53	273·2	13·57	184·1	12·89	166·3	12·18	148·5
115	16·69	278·6	16·17	261·6	13·28	176·4	12·62	159·3	11·93	142·3
120	16·35	267·3	15·84	251·0	13·01	169·3	12·37	153·0	11·69	136·6
125	16·02	256·8	15·53	241·2	12·76	162·8	12·13	147·1	11·46	131·4
130	15·72	247·2	15·23	232·1	12·52	156·7	11·90	141·6	11·25	126·6
135	15·43	238·2	14·96	223·7	12·29	151·1	11·69	136·6	11·05	122·1
140	15·16	230·0	14·69	216·0	12·08	146·0	11·49	132·0	10·86	118·0
145	14·90	222·2	14·44	208·7	11·88	141·1	11·29	127·6	10·68	114·1
150	14·66	215·0	14·21	202·0	11·69	136·6	11·11	123·6	10·51	110·5
155	14·43	208·3	13·98	195·6	11·50	132·4	10·94	119·8	10·35	107 1
160	14·21	202·0	13·77	189·7	11·33	128·5	10·78	116·2	10·19	104·0
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 20 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{13}{16}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	..
20	...	...	...	...	...	...	18·94	358·8
25	...	...	...	...	20·72	429·3	16·97	288·2
30	...	...	19·95	398·0	18·94	358·8	15·53	241·2
35	19·59	384·0	18·49	342·0	17·56	308·4	14·40	207·6
40	18·35	336·7	17·32	300·0	16·45	270·6	13·50	182·4
45	17·32	300·0	16·35	267·3	15·53	241·2	12·76	162·8
50	16·45	270·6	15·53	241·2	14·75	217·6	12·13	147·1
55	15·70	246·5	14·82	219·8	14·08	198·4	11·58	134·2
60	15·05	226·5	14·21	202·0	13·50	182·4	11·11	123·6
65	14·47	209·5	13·67	186·9	12·99	168·8	10·70	114·5
70	13·96	195·0	13·19	174·0	12·53	157·2	10·33	106·8
75	13·50	182·4	12·76	162·8	12·13	147·1	10·00	100·0
80	13·09	171·3	12·37	153·0	11·76	138·3	9·70	94·2
85	12·71	161·6	12·01	144·3	11·42	130·5	9·43	89·0
90	12·37	153·0	11·69	136·6	11·11	123·6	9·18	84·4
95	12·05	145·2	11·39	129·7	10·83	117·4	8·96	80·2
100	11·76	138·3	11·11	123·6	10·57	111·8	8·75	76·5
105	11·49	132·0	10·86	118·0	10·33	106·8	8·55	73·2
110	11·23	126·2	10·62	112·9	10·11	102·2	8·37	70·1
115	11·00	121·0	10·40	108·2	9·90	98·0	8·20	67·3
120	10·78	116·2	10·19	104·0	9·70	94·2	8·05	64·8
125	10·57	111·8	10·00	100·0	9·52	90·6	7·90	62·4
130	10·38	107·7	9·82	96·4	9·35	87·4	7·76	60·2
135	10·19	104·0	9·65	93·1	9·18	84·4	7·63	58·2
140	10·02	100·5	9·48	90·0	9·03	81·6	7·51	56·4
145	9·86	97·2	9·33	87·1	8·88	78·9	7·39	54·6
150	9·70	94·2	9·18	84·4	8·75	76·5	7·28	53·0
155	9·55	91·3	9·04	81·8	8·61	74·2	7·17	51·5
160	9·41	88·6	8·91	79·5	8·49	72·1	7·07	50·1
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{27}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	20·65	426·5
45	...	...	..	...	...	...	20·65	426·5	19·48	379·7
50	...	...	...	...	20·65	426·5	19·60	384·4	18·50	342·4
55	...	...	...	...	19·70	388·2	18·71	350·0	17·65	311·8
60	...	...	...	...	18·87	356·4	17·92	321·3	16·92	286·3
65	...	...	...	...	18·15	329·4	17·23	297·1	16·27	264·7
70	...	...	...	...	17·50	306·3	16·62	276·3	15·69	246·2
75	...	...	20·65	426·5	16·92	286·3	16·07	258·3	15·17	230·2
80	20·65	426·5	17·32	300·2	16·39	268·8	15·57	242·5	14·70	216·2
85	20·04	401·7	19·41	377·0	15·91	253·3	15·12	228·6	14·27	203·8
90	19·48	379·7	18·87	356·4	15·48	239·6	14·70	216·2	13·88	192·8
95	18·97	360·1	18·38	337·9	15·07	227·3	14·32	205·1	13·53	183·0
100	18·50	342·4	17·92	321·3	14·70	216·2	13·97	195·2	13·19	174·2
105	18·06	326·3	17·50	306·3	14·36	206·2	13·64	186·2	12·89	166·1
110	17·65	311·8	17·10	292·7	14·04	197·1	13·34	178·0	12·60	158·9
115	17·27	298·5	16·74	280·2	13·74	188·8	13·06	170·5	12·34	152·2
120	16·92	286·3	16·39	268·8	13·46	181·2	12·79	163·6	12·09	146·1
125	16·58	275·1	16·07	258·3	13·19	174·2	12·54	157·3	11·85	140·5
130	16·27	264·7	15·76	248·5	12·95	167·7	12·31	151·5	11·63	135·3
135	15·97	255·1	15·48	239·6	12·71	161·7	12·09	146·1	11·42	130·5
140	15·69	246·2	15·20	231·2	12·49	156·1	11·88	141·1	11·23	126·1
145	15·42	238·0	14·95	223·5	12·28	151·0	11·68	136·5	11·04	122·0
150	15·17	230·2	14·70	216·2	12·09	146·1	11·49	132·1	10·86	118·1
155	14·93	223·0	14·47	209·4	11·90	141·6	11·31	128·0	10·70	114·5
160	14·70	216·2	14·25	203·1	11·72	137·4	11·14	124·2	10·54	111·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 21 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{27}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	19·60	384·4
25	...	...	...	...	...	...	17·57	308·7
30	...	...	20·65	426·5	19·60	384·4	16·07	258·3
35	20·28	411·4	19·14	366·4	18·17	330·3	14·90	222·2
40	18·99	360·7	17·92	321·3	17·02	289·8	13·97	195·2
45	17·92	321·3	16·92	286·3	16·07	258·3	13·19	174·2
50	17·02	289·8	16·07	258·3	15·26	233·0	12·54	157·3
55	16·25	264·0	15·34	235·3	14·57	212·4	11·98	143·6
60	15·57	242·5	14·70	216·2	13·97	195·2	11·49	132·1
65	14·97	224·3	14·14	200·0	13·44	180·6	11·06	122·4
70	14·44	208·7	13·64	186·2	12·96	168·1	10·68	114·1
75	13·97	195·2	13·19	174·2	12·54	157·3	10·31	106·9
80	13·54	183·3	12·79	163·6	12·16	147·9	10·03	100·6
85	13·15	172·9	12·42	154·4	11·81	139·5	9·75	95·0
90	12·79	163·6	12·09	146·1	11·49	132·1	9·49	90·1
95	12·46	155·3	11·78	138·7	11·20	125·5	9·25	85·6
100	12·16	147·9	11·49	132·1	10·93	119·5	9·03	81·6
105	11·88	141·1	11·23	126·1	10·68	114·1	8·83	78·0
110	11·62	135·0	10·98	120·6	10·45	109·2	8·65	74·8
115	11·37	129·4	10·75	115·6	10·23	104·7	8·47	71·8
120	11·14	124·2	10·54	111·1	10·03	100·6	8·31	69·0
125	10·93	119·5	10·34	106·9	9·84	96·8	8·15	66·5
130	10·73	115·1	10·15	103·0	9·66	93·3	8·01	64·2
135	10·54	111·1	9·97	99·4	9·49	90·1	7·87	62·0
140	10·36	107·3	9·80	96·1	9·33	87·0	7·75	60·0
145	10·19	103·8	9·64	93·0	9·18	84·3	7·62	58·2
150	10·03	100·6	9·49	90·1	9·03	81·6	7·51	56·4
155	9·87	97·5	9·34	87·3	8·90	79·2	7·40	54·8
160	9·73	94·7	9·21	84·8	8·77	76·9	7·30	53·3
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{7}{8}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	20·15	406·0
50	...	...	...	...	...	...	20·27	411·0	19·13	366·0
55	...	...	...	...	20·37	415·0	19·34	374·1	18·25	333·2
60	...	...	...	...	19·52	381·0	18·53	343·5	17·49	306·0
65	...	...	...	..	18·76	352·1	17·82	317·5	16·82	282·9
70	...	...	...	...	18·09	327·4	17·18	295·2	16·22	263·1
75	...	...	...	...	17·49	306·0	16·61	276·0	15·68	246·0
80	...	...	20·68	427·8	16·94	287·2	16·09	259·1	15·19	231·0
85	20·72	429·5	20·07	403·0	16·45	270·7	15·62	244·2	14·75	217·7
90	20·15	406·0	19·52	381·0	16·00	256·0	15·19	231·0	14·35	206·0
95	19·62	384·9	19·00	361·2	15·58	242·8	14·80	219·1	13·98	195·4
100	19·13	366·0	18·53	343·5	15·19	231·0	14·44	208·5	13·63	186·0
105	18·67	348·8	18·09	327·4	14·84	220·2	14·10	198·8	13·32	177·4
110	18·25	333·2	17·68	312·8	14·51	210·5	13·78	190·0	13·02	169·6
115	17·86	319·0	17·30	299·4	14·20	201·6	13·49	182·0	12·74	162·5
120	17·49	306·0	16·94	287·2	13·91	193·5	13·22	174·7	12·49	156·0
125	17·14	294·0	16·61	276·0	13·63	186·0	12·96	168·0	12·24	150·0
130	16·82	282·9	16·29	265·6	13·38	179·0	12·71	161·7	12·02	144·4
135	16·51	272·6	16·00	256·0	13·14	172·6	12·49	156·0	11·80	139·3
140	16·22	263·1	15·71	247·0	12·91	166·7	12·27	150·6	11·60	134·5
145	15·94	254·2	15·45	238·7	12·69	161·1	12·06	145·6	11·40	130·1
150	15·68	246·0	15·19	231·0	12·49	156·0	11·87	141·0	11·22	126·0
155	15·43	238·2	14·95	223·7	12·29	151·1	11·69	136·6	11·05	122·1
160	15·19	231·0	14·72	216·9	12·10	146·6	11·51	132·5	10·88	118·5
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{7}{8}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	20·27	411·0
25	...	...	...	...	...	...	18·16	330·0
30	...	...	...	...	20·27	411·0	16·61	276·0
35	20·97	439·9	19·79	391·7	18·79	353·1	15·40	237·4
40	19·63	385·6	18·53	343·5	17·60	309·7	14·44	208·5
45	18·53	343·5	17·49	306·0	16·61	276·0	13·63	186·0
50	17·60	309·7	16·61	276·0	15·78	249·0	12·96	168·0
55	16·79	282·1	15·85	251·4	15·06	226·9	12·38	153·2
60	16·09	259·1	15·19	231·0	14·44	208·5	11·87	141·0
65	15·48	239·6	14·61	213·6	13·89	192·9	11·42	130·6
70	14·93	222·9	14·10	198·8	13·40	179·5	11·03	121·7
75	14·44	208·5	13·63	186·0	12·96	168·0	10·67	114·0
80	13·99	195·8	13·22	174·7	12·56	157·8	10·35	107·2
85	13·59	184·6	12·83	164·8	12·20	148·9	10·06	101·2
90	13·22	174·7	12·49	156·0	11·87	141·0	9·79	96·0
95	12·87	165·8	12·17	148·1	11·57	133·8	9·55	91·2
100	12·56	157·8	11·87	141·0	11·29	127·5	9·32	87·0
105	12·27	150·6	11·60	134·5	11·03	121·7	9·11	83·1
110	12·00	144·0	11·34	128·7	10·79	116·4	8·92	79·6
115	11·75	138·0	11·10	123·3	10·56	111·6	8·74	76·4
120	11·51	132·5	10·88	118·5	10·35	107·2	8·57	73·5
125	11·29	127·5	10·67	114·0	10·15	103·2	8·41	70·8
130	11·08	122·8	10·48	109·8	9·97	99·4	8·26	68·3
135	10·88	118·5	10·29	106·0	9·79	96·0	8·12	66·0
140	10·70	114·4	10·12	102·4	9·63	92·7	7·99	63·8
145	10·52	110·7	9·95	99·1	9·47	89·7	7·86	61·8
150	10·35	107·2	9·79	96·0	9·32	87·0	7·74	60·0
155	10·19	103·9	9·64	93·0	9·18	84·3	7·63	58·2
160	10·04	100·9	9·50	90·3	9·05	81·9	7·52	56·6
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{29}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	20·81	433·1
50	...	...	...	...	...	...	20·94	438·4	19·75	390·4
55	...	...	...	...	...	...	19·97	399·1	18·85	355·4
60	...	...	...	...	20·16	406·4	19·14	366·3	18·06	326·3
65	...	...	...	...	19·38	375·6	18·40	338·6	17·37	301·6
70	...	...	...	...	18·68	349·2	17·74	314·8	16·75	280·5
75	...	...	...	...	18·06	326·3	17·15	294·3	16·19	262·2
80	...	...	...	...	17·50	306·3	16·62	276·2	15·69	246·2
85	...	...	20·73	429·9	16·99	288·6	16·13	260·3	15·23	232·1
90	20·81	433·1	20·16	406·4	16·52	272·9	15·69	246·2	14·81	219·5
95	20·26	410·6	19·63	385·3	16·09	258·8	15·28	233·6	14·43	208·3
100	19·75	390·4	19·14	366·3	15·69	246·2	14·90	222·2	14·07	198·2
105	19·29	372·0	18·68	349·2	15·32	234·8	14·55	211·9	13·75	189·0
110	18·85	355·4	18·26	333·6	14·98	224·4	14·23	202·5	13·44	180·7
115	18·44	340·2	17·87	319·3	14·66	214·9	13·93	194·0	13·15	173·1
120	18·06	326·3	17·50	306·3	14·36	206·2	13·64	186·1	12·89	166·1
125	17·70	313·5	17·15	294·3	14·07	198·2	13·37	178·9	12·64	159·7
130	17·37	301·6	16·82	283·2	13·81	190·8	13·12	172·3	12·40	153·8
135	17·05	290·7	16·52	272·9	13·56	183·9	12·89	166·1	12·18	148·3
140	16·75	280·5	16·23	263·4	13·26	177·6	12·66	160·4	11·97	143·2
145	16·46	271·1	15·95	254·5	13·10	171·6	12·45	155·1	11·77	138·5
150	16·19	262·2	15·69	246·2	12·89	166·1	12·25	150·1	11·58	134·1
155	15·93	254·0	15·44	238·5	12·68	161·0	12·06	145·5	11·40	130·0
160	15·69	246·2	15·20	231·2	12·49	156·1	11·88	141·1	11·23	126·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 23 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{29}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	20·94	438·4
25	...	...	...	...	...	...	18·76	351·9
30	...	...	...	...	20·94	438·4	17·15	294·3
35	...	...	20·44	417·8	19·40	376·6	15·91	253·1
40	20·28	411·4	19·14	366·3	18·17	330·3	14·90	222·2
45	19·14	366·3	18·06	326·3	17·15	294·3	14·07	198·2
50	18·17	330·3	17·15	294·3	16·29	265·4	13·37	178·9
55	17·34	300·8	16·37	268·0	15·55	241·8	12·77	163·2
60	16·62	276·2	15·69	246·2	14·90	222·2	12·25	150·1
65	15·98	255·4	15·09	227·7	14·33	205·5	11·79	139·0
70	15·41	237·6	14·55	211·9	13·83	191·3	11·38	129·5
75	14·90	222·2	14·07	198·2	13·37	178·9	11·01	121·3
80	14·44	208·7	13·64	186·1	12·96	168·1	10·68	114·1
85	14·02	196·7	13·25	175·5	12·59	158·6	10·38	107·7
90	13·64	186·1	12·89	166·1	12·25	150·1	10·10	102·1
95	13·29	176·7	12·56	157·7	11·94	142·5	9·85	97·0
100	12·96	168·1	12·25	150·1	11·65	135·7	9·61	92·4
105	12·66	160·4	11·97	143·2	11·38	129·5	9·40	88·3
110	12·38	153·4	11·70	137·0	11·13	123·9	9·20	84·6
115	12·12	147·0	11·46	131·3	10·90	118·8	9·01	81·2
120	11·88	141·1	11·23	126·1	10·68	114·1	8·83	78·0
125	11·65	135·7	11·01	121·3	10·47	109·7	8·67	75·1
130	11·43	130·7	10·81	116·8	10·28	105·7	8·51	72·5
135	11·23	126·1	10·62	112·7	10·10	102·1	8·37	70·0
140	11·03	121·8	10·43	108·9	9·93	98·6	8·23	67·7
145	10·85	117·8	10·26	105·4	9·77	95·4	8·10	65·6
150	10·68	114·1	10·10	102·1	9·61	92·4	7·97	63·6
155	10·51	110·6	9·95	99·0	9·47	89·7	7·86	61·8
160	10·36	107·3	9·80	96·0	9·33	87·0	7·75	60·0
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{15}{16}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	20·38	415·6
55	...	...	...	...	...	...	20·61	424·9	19·45	378·3
60	...	...	...	...	20·80	432·6	19·74	390·0	18·63	347·3
65	...	...	...	...	19·99	399·8	18·98	360·4	17·91	321·0
70	...	...	...	...	19·28	371·7	18·30	335·1	17·28	298·5
75	...	...	...	...	18·63	347·3	17·69	313·2	16·70	279·0
80	...	...	...	...	18·05	326·0	17·14	294·0	16·18	262·0
85	...	...	...	...	17·52	307·1	16·64	277·0	15·71	246·9
90	...	...	20·80	432·6	17·04	290·4	16·18	262·0	15·28	233·5
95	20·90	437·1	20·25	410·2	16·59	275·4	15·76	248·5	14·88	221·5
100	20·38	415·6	19·74	390·0	16·18	262·0	15·37	236·4	14·51	210·8
105	19·90	396·0	19·28	371·7	15·80	249·8	15·01	225·4	14·18	201·0
110	19·45	378·3	18·84	355·0	15·45	238·7	14·67	215·4	13·86	192·1
115	19·03	362·1	18·43	339·9	15·12	228·6	14·36	206·3	13·56	184·0
120	18·63	347·3	18·05	326·0	14·81	219·3	14·07	198·0	13·29	176·6
125	18·26	333·6	17·69	313·2	14·51	210·8	13·79	190·3	13·03	169·8
130	17·91	321·0	17·36	301·3	14·24	202·9	13·53	183·2	12·78	163·5
135	17·59	309·4	17·04	290·4	13·98	195·6	13·29	176·6	12·55	157·7
140	17·28	298·5	16·74	280·2	13·74	188·8	13·06	170·5	12·34	152·2
145	16·98	288·4	16·45	270·8	13·51	182·5	12·84	164·8	12·13	147·2
150	16·70	279·0	16·18	262·0	13·29	176·6	12·63	159·6	11·93	142·5
155	16·44	270·2	15·93	253·7	13·08	171·1	12·43	154·6	11·75	138·1
160	16·18	262·0	15·68	246·0	12·88	166·0	12·24	150·0	11·57	134·0
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{15}{16}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	19·35	374·6
30	...	...	...	...	...	...	17·69	313·2
35	...	...	...	...	20·02	400·9	16·41	269·3
40	20·92	438·0	19·74	390·0	18·75	351·6	15·37	236·4
45	19·74	390·0	18·63	347·3	17·69	313·2	14·51	210·8
50	18·75	351·6	17·69	313·2	16·80	282·4	13·79	190·3
55	17·89	320·1	16·89	285·2	16·04	257·3	13·17	173·5
60	17·14	294·0	16·18	262·0	15·37	236·4	12·63	159·6
65	16·48	271·8	15·56	242·3	14·78	218·6	12·15	147·7
70	15·90	252·8	15·01	225·4	14·26	203·4	11·73	137·6
75	15·37	236·4	14·51	210·8	13·79	190·3	11·35	128·8
80	14·90	222·0	14·07	198·0	13·37	178·8	11·01	121·2
85	14·46	209·2	13·66	186·7	12·98	168·6	10·69	114·4
90	14·07	198·0	13·29	176·6	12·63	159·6	10·41	108·4
95	13·70	187·8	12·95	167·6	12·31	151·5	10·15	103·0
100	13·37	178·8	12·63	159·6	12·01	144·2	9·90	98·1
105	13·06	170·5	12·34	152·2	11·73	137·6	9·68	93·7
110	12·77	163·0	12·06	145·6	11·47	131·6	9·47	89·7
115	12·50	156·2	11·81	139·5	11·23	126·2	9·28	86·1
120	12·24	150·0	11·57	134·0	11·01	121·2	9·10	82·8
125	12·01	144·2	11·35	128·8	10·79	116·5	8·93	79·7
130	11·78	138·9	11·14	124·1	10·59	112·3	8·76	76·8
135	11·57	134·0	10·94	119·7	10·41	108·4	8·61	74·2
140	11·37	129·4	10·75	115·7	10·23	104·7	8·47	71·8
145	11·18	125·1	10·58	111·9	10·06	101·3	8·34	69·5
150	11·01	121·2	10·41	108·4	9·90	98·1	8·21	67·4
155	10·83	117·4	10·25	105·0	9·75	95·1	8·09	65·4
160	10·67	114·0	10·10	102·0	9·61	92·4	7·97	63·6
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{3\frac{1}{2}}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	21·01	441·6
55	...	...	...	...	...	...	...	...	20·05	402·0
60	...	...	...	...	...	...	20·35	414·3	19·21	369·0
65	...	...	...	...	20·61	424·8	19·57	382·9	18·46	341·0
70	...	...	...	...	19·87	394·9	18·86	356·0	17·80	317·1
75	...	...	...	...	19·21	369·0	18·24	332·7	17·21	296·4
80	...	...	...	...	18·61	346·3	17·67	312·2	16·68	278·2
85	...	...	...	...	18·06	326·2	17·15	294·2	16·19	262·2
90	...	...	...	...	17·56	308·5	16·68	278·2	15·74	248·0
95	...	...	20·87	435·8	17·10	292·5	16·24	263·9	15·33	235·2
100	...	...	20·35	414·3	16·68	278·2	15·84	251·0	14·96	223·8
105	20·51	420·8	19·87	394·9	16·28	265·2	15·47	239·3	14·61	213·4
110	20·05	402·0	19·42	377·2	15·92	253·5	15·12	228·7	14·28	204·0
115	19·61	384·7	19·00	361·1	15·58	242·7	14·80	219·0	13·97	195·3
120	19·21	369·0	18·61	346·3	15·26	232·8	14·49	210·1	13·69	187·5
125	18·82	354·4	18·24	332·7	14·96	223·8	14·21	202·0	13·42	180·2
130	18·46	341·0	17·89	320·1	14·67	215·4	13·94	194·4	13·17	173·5
135	18·13	328·6	17·56	308·5	14·41	207·6	13·69	187·5	12·93	167·3
140	17·80	317·1	17·25	297·6	14·15	200·4	13·45	181·0	12·71	161·5
145	17·50	306·4	16·96	287·6	13·92	193·7	13·22	174·9	12·49	156·2
150	17·21	296·4	16·68	278·2	13·69	187·5	13·01	169·3	12·29	151·2
155	16·94	287·0	16·41	269·4	13·47	181·6	12·81	164·0	12·10	146·5
160	16·68	278·2	16·16	261·2	13·27	176·1	12·61	159·1	11·92	142·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{3\frac{1}{2}}{32}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	19·95	398·0
30	...	...	...	...	...	...	18·24	332·7
35	...	...	...	...	20·64	426·0	16·91	286·0
40	...	...	20·35	414·3	19·32	373·5	15·84	251·0
45	20·35	414·3	19·21	369·0	18·24	332·7	14·96	223·8
50	19·32	373·5	18·24	332·7	17·32	300·0	14·21	202·0
55	18·44	340·1	17·40	303·0	16·53	273·3	13·57	184·2
60	17·67	312·2	16·68	278·2	15·84	251·0	13·01	169·3
65	16·99	288·7	16·04	257·3	15·23	232·1	12·52	156·7
70	16·38	268·5	15·47	239·3	14·69	216·0	12·08	146·0
75	15·84	251·0	14·96	223·8	14·21	202·0	11·69	136·6
80	15·35	235·7	14·49	210·1	13·77	189·7	11·33	128·5
85	14·90	222·1	14·07	198·1	13·37	178·9	11·01	121·3
90	14·49	210·1	13·69	187·5	13·01	169·3	10·72	114·9
95	14·12	199·4	13·34	177·9	12·6,	160·7	10·44	109·1
100	13·77	189·7	13·01	169·3	12·37	153·0	10·19	104·4
105	13·45	181·0	12·71	161·5	12·08	146·0	9·96	99·3
110	13·15	173·0	12·43	154·5	11·81	139·6	9·75	95·1
115	12·87	165·7	12·16	148·0	11·56	133·8	9·55	91·2
120	12·61	159·1	11·92	142·1	11·33	128·5	9·36	87·6
125	12·37	153·0	11·69	136·6	11·11	123·6	9·18	84·4
130	12·14	147·3	11·47	131·6	10·91	119·0	9·01	81·2
135	11·92	142·1	11·27	127·0	10·72	114·9	8·86	78·6
140	11·71	137·2	11·07	122·6	10·53	111·0	8·71	76·0
145	11·52	132·7	10·89	118·6	10·36	107·3	8·57	73·5
150	11·33	128·5	10·72	114·9	10·19	104·0	8·44	71·3
155	11·16	124·5	10·55	111·3	10·04	100·8	8·32	69·2
160	10·99	120·8	10·39	108·0	9·89	97·8	8·20	67·2
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate 1 inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	20·64	426·3
60	...	...	...	...	...	...	20·96	439·5	19·78	391·3
65	...	...	...	...	...	...	20·15	406·1	19·01	361·6
70	...	...	...	...	20·46	418·8	19·43	377·5	18·33	336·2
75	...	...	...	...	19·78	391·3	18·78	352·8	17·72	314·2
80	...	...	...	...	19·16	367·2	18·19	331·1	17·17	295·0
85	...	...	...	...	18·60	346·0	17·66	312·0	16·67	278·0
90	...	...	...	...	18·08	327·1	17·17	295·0	16·21	262·8
95	...	...	...	...	17·61	310·2	16·72	279·7	15·79	249·3
100	...	...	...	...	17·17	295·0	16·31	266·1	15·40	237·2
105	...	...	20·46	418·8	16·77	281·2	15·92	253·7	15·04	226·1
110	20·64	426·3	20·00	400·0	16·39	268·7	15·57	242·4	14·70	216·1
115	20·20	408·0	19·57	382·9	16·04	257·3	15·23	232·1	14·39	207·0
120	19·78	391·3	19·16	367·2	15·71	246·8	14·92	222·7	14·09	198·6
125	19·38	375·9	18·78	352·8	15·40	237·2	14·63	214·0	13·81	190·9
130	19·01	361·6	18·42	339·4	15·11	228·3	14·35	206·0	13·55	183·8
135	18·66	348·5	18·08	327·1	14·83	220·0	14·09	198·6	13·31	177·2
140	18·33	336·2	17·76	315·6	14·57	212·4	13·84	191·7	13·08	171·1
145	18·02	324·8	17·46	304·9	14·32	205·3	13·61	185·3	12·86	165·4
150	17·72	314·2	17·17	295·0	14·09	198·6	13·39	179·4	12·65	160·1
155	17·44	304·3	16·90	285·6	13·87	192·4	13·18	173·8	12·45	155·1
160	17·17	295·0	16·64	276·9	13·66	186·6	12·98	168·5	12·26	150·5
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate 1 inch thick.

TABLE No. 26 *continued.*

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	20·54	422·1
30	...	...	...	...	...	...	18·78	352·8
35	...	...	...	...	...	...	17·41	303·2
40	...	...	20·96	439·5	19·90	396·1	16·31	266·1
45	20·96	439·5	19·78	391·3	18·78	352·8	15·40	237·2
50	19·90	396·1	18·78	352·8	17·83	318·1	14·63	214·0
55	18·99	360·6	17·92	321·2	17·02	289·7	13·97	195·1
60	18·19	331·1	17·17	295·0	16·31	266·1	13·39	179·4
65	17·49	306·1	16·51	272·7	15·68	246·0	12·88	166·0
70	16·87	284·6	15·92	253·7	15·13	228·9	12·43	154·6
75	16·31	266·1	15·40	237·2	14·63	214·0	12·03	144·2
80	15·80	249·8	14·92	222·7	14·18	201·0	11·66	136·0
85	15·34	235·5	14·49	210·0	13·77	189·6	11·33	128·4
90	14·92	222·7	14·09	198·6	13·39	179·4	11·02	121·6
95	14·53	211·3	13·73	188·5	13·04	170·2	10·74	115·5
100	14·18	201·0	13·39	179·4	12·73	162·0	10·49	110·0
105	13·84	191·7	13·08	171·1	12·43	154·6	10·25	105·0
110	13·54	183·3	12·79	163·6	12·16	147·8	10·03	100·5
115	13·25	175·6	12·52	156·7	11·90	141·7	9·82	96·4
120	12·98	168·5	12·26	150·5	11·66	136·0	9·62	92·7
125	12·73	162·0	12·03	144·7	11·43	130·8	9·44	89·2
130	12·49	156·0	11·80	139·3	11·22	126·0	9·27	86·0
135	12·26	150·5	11·59	134·4	11·02	121·6	9·11	83·0
140	12·05	145·3	11·39	129·8	10·83	117·4	8·96	80·3
145	11·85	140·5	11·20	125·5	10·66	113·6	8·81	77·5
150	11·66	136·0	11·02	121·6	10·49	110·0	8·68	75·3
155	11·48	131·8	10·85	117·8	10·32	106·6	8·55	73·1
160	11·31	127·9	10·69	114·3	10·17	103·5	8·42	71·0
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{1}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	..	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	..	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	20·35	414·3
65	...	...	...	...	...	...	20·73	430·0	19·56	382·9
70	...	...	...	...	...	...	19·99	399·7	18·86	356·0
75	...	...	...	...	20·35	414·3	19·32	373·5	18·24	332·6
80	...	...	...	...	19·71	388·8	18·72	350·5	17·67	312·2
85	...	...	...	...	19·13	366·2	18·17	330·2	17·15	294·2
90	...	...	...	...	18·60	346·2	17·67	312·2	16·68	278·2
95	...	...	...	...	18·12	328·3	17·20	296·1	16·24	263·8
100	...	...	...	...	17·67	312·2	16·78	281·6	15·84	251·0
105	...	...	...	...	17·25	297·6	16·38	268·5	15·47	239·3
110	...	...	20·58	423·6	16·86	284·4	16·01	256·5	15·12	228·7
115	20·78	432·0	20·13	405·4	16·50	272·3	15·67	245·6	14·80	219·0
120	20·35	414·3	19·71	388·8	16·16	261·2	15·35	235·6	14·49	210·1
125	19·95	398·0	19·32	373·5	15·84	251·0	15·05	226·5	14·21	202·0
130	19·56	382·9	18·95	359·3	15·54	241·5	14·76	218·0	13·94	194·4
135	19·20	368·9	18·60	346·2	15·26	232·8	14·49	210·1	13·69	187·4
140	18·86	356·0	18·28	334·1	14·99	224·7	14·24	202·8	13·45	181·0
145	18·54	343·9	17·96	322·8	14·73	217·2	14·00	196·0	13·22	174·9
150	18·24	332·6	17·67	312·2	14·49	210·1	13·77	189·7	13·01	169·3
155	17·94	322·1	17·38	302·3	14·26	203·5	13·55	183·8	12·80	164·0
160	17·67	312·2	17·12	293·1	14·05	197·4	13·35	178·2	12·61	159·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{1}{32}$ inch thick.

Pressure per sq. in	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	..	...	...	19·32	373·5
35	...	...	...	...	...	...	17·91	321·0
40	...	...	...	...	20·48	419·4	16·78	281·6
45	...	...	20·35	414·3	19·32	373·5	15·84	251·0
50	20·48	419·4	19·32	373·5	18·35	336·7	15·05	226·5
55	19·54	381·8	18·44	340·0	17·51	306·6	14·36	206·4
60	18·72	350·5	17·67	312·2	16·78	281·6	13·77	189·7
65	18·00	324·0	16·99	288·6	16·13	260·4	13·25	175·6
70	17·35	301·3	16·38	268·5	15·56	242·2	12·78	163·5
75	16·78	281·6	15·84	251·0	15·05	226·5	12·37	153·0
80	16·26	264·3	15·35	235·6	14·58	212·7	11·99	143·8
85	15·78	249·1	14·90	222·1	14·16	200·5	11·65	135·7
90	15·35	235·6	14·49	210·1	13·77	189·7	11·33	128·5
95	14·95	223·5	14·12	199·4	13·42	180·0	11·04	122·0
100	14·58	212·7	13·77	189·7	13·09	171·3	10·78	116·2
105	14·24	202·8	13·45	181·0	12·78	163·5	10·53	111·0
110	13·92	193·9	13·15	173·0	12·50	156·3	10·30	106·2
115	13·63	185·7	12·87	165·7	12·24	149·8	10·09	101·8
120	13·35	178·2	12·61	159·1	11·99	143·8	9·89	97·8
125	13·09	171·3	12·37	153·0	11·76	138·3	9·70	94·2
130	12·84	165·0	12·13	147·3	11·54	133·2	9·53	90·8
135	12·61	159·1	11·92	142·1	11·33	128·5	9·36	87·6
140	12·39	153·6	11·71	137·2	11·14	124·1	9·20	84·7
145	12·18	148·5	11·52	132·7	10·95	120·0	9·05	82·0
150	11·99	143·8	11·33	128·5	10·78	116·2	8·91	79·5
155	11·80	139·3	11·16	124·5	10·61	112·6	8·78	77·1
160	11·62	135·1	10·99	120·8	10·45	109·3	8·65	74·9
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{1}{16}$ inch thick.

Pressure per sq.in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	..	...	...	...	...	20·92	438·0
65	...	...	...	...	...	...	...	...	20·11	404·7
70	...	...	...	...	...	...	20·55	422·5	19·39	376·2
75	...	...	...	...	20·92	438·0	19·87	394·8	18·75	351·6
80	...	...	...	...	20·27	411·0	19·24	370·5	18·16	330·0
85	...	...	...	...	19·67	387·1	18·68	349·0	17·63	310·9
90	...	...	...	...	19·13	366·0	18·16	330·0	17·14	294·0
95	...	...	...	...	18·63	347·0	17·69	312·9	16·69	278·8
100	...	...	...	...	18·16	330·0	17·25	297·6	16·28	265·2
105	...	...	...	...	17·73	314·5	16·84	283·7	15·90	252·8
110	...	...	...	...	17·33	300·5	16·46	271·0	15·54	241·6
115	...	...	20·70	428·6	16·96	287·7	16·11	259·5	15·21	231·3
120	20·92	438·0	20·27	411·0	16·61	276·0	15·78	249·0	14·90	222·0
125	20·51	420·7	19·87	394·8	16·28	265·2	15·46	239·2	14·60	213·3
130	20·11	404·7	19·49	379·8	15·97	255·2	15·17	230·3	14·33	205·3
135	19·74	390·0	19·13	366·0	15·68	246·0	14·90	222·0	14·07	198·0
140	19·39	376·2	18·79	353·1	15·40	237·4	14·63	214·2	13·82	191·1
145	19·06	363·5	18·47	341·1	15·14	229·4	14·39	207·1	13·59	184·7
150	18·75	351·6	18·16	330·0	14·90	222·0	14·15	200·4	13·37	178·8
155	18·45	340·4	17·87	319·5	14·66	215·0	13·93	194·1	13·16	173·2
160	18·16	330·0	17·60	309·7	14·44	208·5	13·72	188·2	12·96	168·0
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 28 *continued.*

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{1}{16}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	..	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	19·87	394·8
35	...	...	...	...	...	...	18·41	339·2
40	...	...	...	...	...	...	17·25	297·6
45	...	...	20·92	438·0	19·87	394·8	16·28	265·2
50	...	...	19·87	394·8	18·86	355·9	15·46	239·2
55	20·09	403·6	18·96	359·4	18·00	324·1	14·76	218·0
60	19·24	370·5	18·16	330·0	17·25	297·6	14·15	200·4
65	18·50	342·4	17·46	305·0	16·58	275·1	13·61	185·4
70	17·84	318·4	16·84	283·7	15·99	255·9	13·13	172·6
75	17·25	297·6	16·28	265·2	15·46	239·2	12·71	161·5
80	16·68	278·2	15·78	249·0	14·99	224·7	12·32	151·8
85	16·22	263·2	15·32	234·7	14·55	211·8	11·96	143·2
90	15·78	249·0	14·90	222·0	14·15	200·4	11·64	135·6
95	15·37	236·2	14·51	210·6	13·79	190·1	11·34	128·7
100	14·99	224·7	14·15	200·4	13·42	180·9	11·07	122·6
105	14·63	214·2	13·82	191·1	13·13	172·6	10·82	117·0
110	14·31	204·8	13·51	182·7	12·84	165·0	10·58	112·0
115	14·00	196·1	13·23	175·0	12·57	158·1	10·36	107·4
120	13·72	188·2	12·96	168·0	12·32	151·8	10·15	103·2
125	13·42	180·9	12·71	161·5	12·08	145·9	9·96	99·3
130	13·20	174·2	12·47	155·5	11·85	140·5	9·78	95·7
135	12·96	168·0	12·24	150·0	11·64	135·6	9·61	92·4
140	12·73	162·2	12·03	144·8	11·44	130·9	9·45	89·3
145	12·52	156·8	11·83	140·0	11·25	126·6	9·29	86·4
150	12·32	151·8	11·64	135·6	11·07	122·6	9·15	83·7
155	12·12	147·0	11·46	131·4	10·90	118·8	9·01	81·2
160	11·94	142·6	11·29	127·5	10·74	115·3	8·88	78·9
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces
Iron Plate $1\frac{3}{32}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	..	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...	20·67	427·2
70	...	..	...	...	...	...	...	...	19·92	397·1
75	...	...	...	...	...	...	20·41	416·7	19·26	371·0
80	...	...	...	...	20·82	433·8	19·77	391·0	18·66	348·2
85	...	...	...	...	20·21	408·6	19·19	368·3	18·11	328·1
90	...	...	...	...	19·65	386·2	18·66	348·2	17·61	310·2
95	...	...	...	...	19·13	366·2	18·17	330·2	17·15	294·2
100	...	...	...	...	18·66	348·2	17·72	314·0	16·72	279·8
105	...	...	...	...	18·22	331·9	17·30	299·3	16·33	266·7
110	...	...	...	...	17·80	317·1	16·91	286·0	15·96	254·9
115	...	...	...	...	17·42	303·6	16·54	273·8	15·62	244·0
120	...	...	20·82	433·8	17·06	291·2	16·20	262·6	15·30	234·1
125	...	...	20·41	416·7	16·72	279·8	15·88	252·4	15·00	225·0
130	20·67	427·2	20·02	400·9	16·41	269·2	15·58	242·9	14·71	216·6
135	20·28	411·6	19·65	386·2	16·11	259·5	15·30	234·1	14·45	208·8
140	19·92	397·1	19·30	372·6	15·82	250·4	15·03	226·0	14·19	201·5
145	19·58	383·6	18·97	360·0	15·55	242·0	14·78	218·4	13·95	194·8
150	19·26	371·0	18·66	348·2	15·30	234·1	14·53	211·3	13·73	188·5
155	18·95	359·2	18·36	337·2	15·06	226·8	14·30	204·7	13·51	182·6
160	18·66	348·2	18·08	326·8	14·83	219·9	14·09	198·5	13·30	177·1
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{3}{32}$ inch thick

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	20·41	416·7
35	...	...	...	...	...	...	18·92	358·0
40	...	...	...	...	...	...	17·72	314·0
45	...	...	...	...	20·41	416·7	16·72	279·8
50	...	...	20·41	416·7	19·38	375·6	15·88	252·4
55	20·64	426·0	19·47	379·3	18·49	342·0	15·16	230·0
60	19·77	391·0	18·66	348·2	17·72	314·0	14·53	211·3
65	19·01	361·4	17·94	321·9	17·04	290·3	13·98	195·5
70	18·33	336·0	17·30	299·3	16·43	270·0	13·49	182·0
75	17·72	314·0	16·72	279·8	15·88	252·4	13·05	170·2
80	17·16	294·7	16·20	262·6	15·39	237·0	12·65	160·0
85	16·66	277·7	15·73	247·5	14·94	223·4	12·28	150·9
90	16·20	262·6	15·30	234·1	14·53	211·3	11·95	142·9
95	15·78	249·1	14·90	222·1	14·16	200·5	11·64	135·6
100	15·39	237·0	14·53	211·3	13·81	190·8	11·36	129·2
105	15·03	226·0	14·19	201·5	13·49	182·0	11·10	123·3
110	14·69	216·0	13·88	192·6	13·19	174·0	10·86	118·0
115	14·38	206·8	13·58	184·5	12·91	166·7	10·63	113·1
120	14·09	198·5	13·30	177·1	12·65	160·0	10·42	108·6
125	13·81	190·8	13·05	170·2	12·40	153·8	10·22	104·5
130	13·55	183·7	12·80	163·9	12·17	148·1	10·03	100·7
135	13·30	177·1	12·57	158·1	11·95	142·9	9·86	97·2
140	13·07	171·0	12·35	152·6	11·74	138·0	9·69	94·0
145	12·85	165·3	12·15	147·6	11·55	133·4	9·53	90·9
150	12·65	160·0	11·95	142·9	11·36	129·2	9·38	88·1
155	12·45	155·0	11·76	138·4	11·19	125·2	9·24	85·4
160	12·26	150·3	11·59	134·3	11·02	121·5	9·11	83·0
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{1}{8}$ inch thick.

Pressure per sq. in.	A*		B*		C*		D*		E*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...	..	...
70	...	...	...	...	...	...	...	...	20·46	418·5
75	...	...	..	...	...	...	20·95	439·2	19·77	391·0
80	...	...	...	...	...	...	20·30	412·1	19·15	367·0
85	...	...	...	...	20·75	430·7	19·70	388·2	18·59	345·7
90	...	...	...	..	20·17	407·1	19·15	367·0	18·08	326·0
95	...	...	...	...	19·64	386·0	18·65	340·0	17·60	310·0
100	...	...	...	...	19·15	367·0	18·19	330·9	17·17	294·8
105	...	...	...	...	18·70	349·8	17·76	315·4	16·76	281·0
110	...	...	...	...	18·28	334·1	17·36	301·3	16·38	268·5
115	...	...	...	...	17·88	319·9	16·98	288·5	16·03	257·1
120	...	...	...	...	17·51	306·8	16·63	276·7	15·70	246·6
125	...	...	20·95	439·2	17·17	294·8	16·30	265·9	15·39	237·0
130	...	...	20·55	422·5	16·84	283·6	15·99	255·9	15·10	228·1
135	20·83	433·8	20·17	407·1	16·53	273·4	15·70	246·6	14·83	219·9
140	20·46	418·5	19·81	392·7	16·24	263·8	15·43	238·0	14·57	212·2
145	20·10	404·3	19·48	379·4	15·96	254·9	15·16	230·0	14·32	205·1
150	19·77	391·0	19·15	367·0	15·70	246·6	14·92	222·6	14·09	198·5
155	19·45	378·6	18·85	355·3	15·45	238·9	14·68	215·6	13·86	192·3
160	19·15	367·0	18·56	344·4	15·22	231·6	14·45	209·0	13·65	186·5
	A*		B*		C*		D*		E*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{1}{8}$ inch thick.

Pressure per sq. in.	F*		G*		H*		I*	
	Pitch.	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	20·95	439·2
35	...	...	...	...	...	...	19 42	377·3
40	...	...	...	...	...	...	18·19	330·9
45	...	...	...	...	20·95	439·2	17·17	294·8
50	...	...	20·95	439·2	19·89	395·8	16·30	265·9
55	...	...	19·99	399·8	18·98	360·4	15·56	242·2
60	20·30	412·1	19·15	367·0	18·19	330·9	14·92	222·6
65	19·51	380·8	18·41	339·2	17·49	305·9	14·35	205·9
70	18·81	354·1	17·76	315·4	16·86	284·4	13·84	191·6
75	18·19	330·9	17·17	294·8	16·30	265·9	13·39	179·2
80	17·62	310·5	16·63	276·7	15·80	249·6	12·97	168·4
85	17·10	292·6	16·15	260·8	15·34	235·3	12·60	158·8
90	16·63	276·7	15·70	246·6	14·92	222·6	12·26	150·4
95	16·20	262·5	15·29	234·0	14·53	211·2	11·95	142·8
100	15·80	249·6	14·92	222·6	14·17	200·9	11·66	135·9
105	15·43	238·0	14 57	212·2	13·84	191·6	11·39	129·7
110	15·08	227·5	14·24	202·9	13·53	183·2	11·14	124·1
115	14·76	217·8	13·94	194·3	13·24	175·5	10·91	119·0
120	14·45	209·0	13·65	186·5	12·97	168·4	10·69	114·3
125	14·17	200·9	13·39	179·2	12·72	161·9	10·48	109·9
130	13·90	193·4	13·13	172·6	12·48	155·9	10·29	105·9
135	13·65	186·5	12·90	166·4	12·26	150·4	10·11	102·2
140	13·42	180·0	12·67	160·7	12·05	145·2	9·94	98·8
145	13·19	174·0	12·46	155·3	11·85	140·4	9·77	95·6
150	12·97	168·4	12·26	150·4	11·66	135·9	9·62	92·6
155	12·77	163·2	12·07	145·7	11·48	131·7	9·47	89·8
160	12·58	158·2	11·89	141·3	11·30	127·8	9·34	87·2
	F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

Stress on Iron Stays, 5000 lbs. per square inch of net section.

The following notes will facilitate the use of the Tables which immediately follow, numbered 31 to 35 and Nos. 254 to 256.

(1) If the working pressure be 120 lbs., the surface to be supported by one stay 175 square inches, and the size of the stay be required :—

Then, opposite 120 lbs. in Table No. 34, the surface, 175 square inches, is found under the diameter 2 $^5/_{16}$ inches, and area 4·2 square inches, which is the size of stay required.

(2) If the surface be 120 square inches, the stay 1⅞ inch diameter, area 2·7612 square inches, and working pressure be required :—

Then, in Table No. 33, 1⅞ inch diameter stay is found; and in the column under the area 2·7612 square inches, and 1⅞ inch diameter, the surface is 120 square inches, and opposite it the pressure is 115 lbs.; this is the working pressure suitable.

(3) If the stay be 1 inch diameter, the area ·7854 square inch, the working pressure 80 lbs., and the greatest surface for such size of stay and working pressure be required :—

Then, in Table No. 31, 1 inch stay is found, and opposite 80 lbs. in the column for 1 inch diameter, area ·7854 inch, the surface is 49 square inches; this is the surface suitable for such stay and pressure.

When the surface is not found opposite the pressure, it will be on the side of safety to adopt the larger size of stay over the next greater surface on the right.

The diameter is always the net effective diameter, or diameter at the bottom of the thread, if screwed; and the area, the net sectional area at the smallest part of the stay.

When the stays are not screwed, but have eyes or palms on the ends, the net sectional area of the Iron in the eyes or palms should be in excess of that in the body of the stay. The eyes should have a sectional area of metal of about 50 per cent. greater than that in the body of the stay, and the palm ends should also have a net section of at least 50 per cent. above that in the body of the stay. The distance from the centre of the holes, for the bolts or rivets, to the outer end of palms should be about twice the diameter of the bolts or rivets.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

TABLE No. 31.

Stress on Iron Stay, 5000 lbs. per square inch of net section.*

Pressure per square inch.	Area 0·1963 sq. inch. Diam. ½ inch.	Area 0·2485 sq. inch. Diam. 9/16 inch.	Area 0·3068 sq. inch. Diam. ⅝ inch.	Area 0·3712 sq. inch Diam. 11/16 inch.	Area 0·4417 sq. inch. Diam. ¾ inch.	Area 0·5184 sq. inch. Diam. 13/16 inch.	Area 0·6013 sq. inch. Diam. ⅞ inch.	Area 0·6902 sq. inch. Diam. 15/16 inch.	Area 0·7854 sq. inch. Diam. 1 inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	196·3	248·5	306·8	371·2	441·7	518·4	601·3	690·2	785·4
10	98·1	124·2	153·4	185·6	220·8	259·2	300·6	345·1	392·7
15	65·4	82·8	102·2	123·7	147·2	172·8	200·4	230·0	261·8
20	49·0	62·1	76·7	92·8	110·4	129·6	150·3	172·5	196·3
25	39·2	49·7	61·3	74·2	88·3	103·6	120·2	138·0	157·0
30	32·7	41·4	51·1	61·8	73·6	86·4	100·2	115·0	130·9
35	28·0	35·5	43·8	53·0	63·1	74·0	85·9	98·6	112·2
40	24·5	31·0	38·3	46·4	55·2	64·8	75·1	86·2	98·1
45	21·8	27·6	34·0	41·2	49·0	57·6	66·8	76·7	87·2
50	19·6	24·8	30·6	37·1	44·1	51·8	60·1	69·0	78·5
55	17·8	22·5	27·8	33·7	40·1	47·1	54·6	62·7	71·4
60	16·3	20·7	25·5	30·9	36·8	43·2	50·1	57·5	65·4
65	15·1	19·1	23·6	28·5	33·9	39·8	46·2	53·1	60·4
70	14·0	17·7	21·9	26·5	31·5	37·0	42·9	49·3	56·1
75	13·0	16·5	20·4	24·7	29·4	34·5	40·0	46·0	52·3
80	12·2	15·5	19·1	23·2	27·6	32·4	37·5	43·1	49·0
85	...	14·6	18·0	21·8	25·9	30·5	35·3	40·6	46·2
90	...	13·8	17·0	20·6	24·5	28·8	33·4	38·3	43·6
95	...	13·0	16·1	19·5	23·2	27·2	31·6	36·3	41·3
100	...	12·4	15·3	18·5	22·0	25·9	30·0	34·5	39·2
105	...	...	14·6	17·6	21·0	24·6	28·6	32·8	37·4
110	...	...	13·9	16·8	20·0	23·5	27·3	31·3	35·7
115	...	...	13·3	16·1	19·2	22·5	26·1	30·0	34·1
120	...	...	12·7	15·4	18·4	21·6	25·0	28·7	32·7
125	...	...	12·2	14·8	17·6	20·7	24·0	27·6	31·4
130	...	...	...	14·2	16·9	19·9	23·1	26·5	30·2
135	...	...	...	13·7	16·3	19·2	22·2	25·5	29·0
140	...	...	...	13·2	15·7	18·5	21·4	24·6	28·0
145	...	...	...	12·8	15·2	17·8	20·7	23·8	27·0
150	...	...	...	12·3	14·7	17·2	20·0	23·0	26·1
155	...	...	...	...	14·2	16·7	19·3	22·2	25·3
160	...	...	...	...	13·8	16·2	18·7	21·5	24·5

* 5000 lbs. per square inch of net section is the greatest working stress to which iron stays, which have been welded or worked in the fire, should be subjected.

Stress on Iron Stay, 5000 lbs. per square inch of net section.*

Pressure per square inch.	Area 0·8866 sq. inch. Diam. $1\frac{1}{16}$ inch.	Area 0·9940 sq. inch. Diam. $1\frac{1}{8}$ inch.	Area 1·1075 sq. inch. Diam. $1\frac{3}{16}$ inch	Area 1·2272 sq. inch. Diam. $1\frac{1}{4}$ inch.	Area 1·3530 sq. inch. Diam. $1\frac{5}{16}$ inch.	Area 1·4849 sq. inch. Diam. $1\frac{3}{8}$ inch.	Area 1·6230 sq. inch. Diam. $1\frac{7}{16}$ inch.	Area 1·7671 sq. inch. Diam. $1\frac{1}{2}$ inch.	Area 1·9175 sq. inch. Diam. $1\frac{9}{16}$ inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	886·6	994·0	...	...	...	...	...	...	...
10	443·3	497·0	553·7	613·6	676·5	742·4	811·5	883·5	958·7
15	295·5	331·3	369·1	409·0	451·0	494·9	541·0	589·0	639·1
20	221·6	248·5	276·8	306·8	338·2	371·2	405·7	441·7	479·3
25	177·3	198·8	221·5	245·4	270·6	296·9	324·6	353·4	383·5
30	147·7	165·6	184·5	204·5	225·5	247·4	270·5	294·5	319·5
35	126·6	142·0	158·2	175·3	193·2	212·1	231·8	252·4	273·9
40	110·8	124·2	138·4	153·4	169·1	185·6	202·8	220·8	239·6
45	98·5	110·4	123·0	136·3	150·3	164·9	180·3	196·3	213·0
50	88·6	99·4	110·7	122·7	135·3	148·4	162·3	176·7	191·7
55	80·6	90·3	100·6	111·5	123·0	134·9	147·5	160·6	174·3
60	73·8	82·8	92·2	102·2	112·7	123·7	135·2	147·2	159·7
65	68·2	76·4	85·1	94·3	104·0	114·2	124·8	135·9	147·5
70	63·3	71·0	79·1	87·6	96·6	106·0	115·9	126·2	136·9
75	59·1	66·2	73·8	81·8	90·2	98·9	108·2	117·8	127·8
80	55·4	62·1	69·2	76·6	84·5	92·8	101·4	110·4	119·8
85	52·1	58·4	65·1	72·1	79·5	87·3	95·4	103·9	112·7
90	49·2	55·2	61·5	68·1	75·1	82·4	90·1	98·1	106·5
95	46·6	52·3	58·2	64·5	71·2	78·1	85·4	93·0	100·9
100	44·3	49·7	55·3	61·3	67·6	74·2	81·1	88·3	95·8
105	42·2	47·3	52·7	58·4	64·4	70·7	77·2	84·1	91·3
110	40·3	45·1	50·3	55·7	61·5	67·4	73·7	80·3	87·1
115	38·5	43·2	48·1	53·3	58·8	64·5	70·5	76·8	83·3
120	36·9	41·4	46·1	51·1	56·3	61·8	67·6	73·6	79·8
125	35·4	39·7	44·3	49·0	54·1	59·3	64·9	70·6	76·7
130	34·1	38·2	42·5	47·1	52·0	57·1	62·4	67·9	73·7
135	32·0	36·8	41·0	45·4	50·1	54·9	60·1	65·4	71·0
140	31·6	35·5	39·5	43·8	48·3	53·0	57·9	63·1	68·4
145	30·5	34·2	38·1	42·3	46·6	51·2	55·9	60·9	66·1
150	29·5	33·1	36·9	40·9	45·1	49·4	54·1	58·9	63·9
155	28·6	32·0	35·7	39·5	43·6	47·8	52·3	57·0	61·8
160	27·7	31·0	34·6	38·3	42·2	46·4	50·7	55·2	59·9

* 5000 lbs. per square inch of net section is the greatest working stress to which iron stays, which have been welded or worked in the fire, should be subjected.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

Stress on Iron Stay, 5000 lbs. per square inch of net section.*

Pressure per square inch.	Area 2·0739 sq. ins.	Area 2·2365 sq. ins.	Area 2·4053 sq. ins.	Area 2·5802 sq. ins.	Area 2·7612 sq. ins.	Area 2·9483 sq. ins.	Area 3·1416 sq. ins.	Area 3·3410 sq. ins.	Area 3·5466 sq. ins.
	Diam. $1\frac{5}{8}$ inch.	Diam. $1\frac{11}{16}$ inch.	Diam. $1\frac{3}{4}$ inch.	Diam. $1\frac{13}{16}$ inch.	Diam. $1\frac{7}{8}$ inch.	Diam. $1\frac{15}{16}$ inch.	Diam. 2 inches.	Diam. $2\frac{1}{16}$ inches.	Diam. $2\frac{1}{8}$ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	691·3	745·5	801·7	860·0	920·4	982·7	...	...	...
20	518·4	559·1	601·3	645·0	690·3	737·0	785·4	835·2	886·6
25	414·7	447·3	481·0	516·0	552·2	589·6	628·3	668·2	709·3
30	345·6	372·7	400·8	430·0	460·2	491·3	523·6	556·8	591·1
35	296·2	319·5	343·6	368·6	394·4	421·1	448·8	477·2	506·6
40	259·2	279·5	300·6	322·5	345·1	368·5	392·7	417·6	443·3
45	230·4	248·5	267·2	286·6	306·8	327·5	349·0	371·2	394·0
50	207·3	223·6	240·5	258·0	276·1	294·8	314·1	334·1	354·6
55	188·5	203·3	218·6	234·5	251·0	268·0	285·6	303·7	322·4
60	172·8	186·3	200·4	215·0	230·1	245·6	261·8	278·4	295·5
65	159·5	172·0	185·0	198·4	212·4	226·7	241·6	257·0	272·8
70	148·1	159·7	171·8	184·3	197·2	210·5	224·4	238·6	253·3
75	138·2	149·1	160·3	172·0	184·0	196·5	209·4	222·7	236·4
80	129·6	139·7	150·3	161·2	172·5	184·2	196·3	208·8	221·6
85	121·9	131·5	141·4	151·7	162·4	173·4	184·8	196·5	208·6
90	115·2	124·2	133·6	143·3	153·4	163·7	174·5	185·6	197·0
95	109·1	117·7	126·5	135·8	145·3	155·1	165·3	175·8	186·6
100	103·6	111·8	120·2	129·0	138·0	147·4	157·0	167·0	177·3
105	98·7	106·5	114·5	122·8	131·4	140·3	149·6	159·1	168·8
110	94·2	101·6	109·3	117·2	125·5	134·0	142·8	151·8	161·2
115	90·1	97·2	104·5	112·1	120·0	128·1	136·5	145·2	154·2
120	86·4	93·1	100·2	107·5	115·0	122·8	130·9	139·2	147·7
125	82·9	89·4	96·2	103·2	110·4	117·9	125·6	133·6	141·8
130	79·7	86·0	92·5	99·2	106·2	113·3	120·8	128·5	136·4
135	76·8	82·8	89·0	95·5	102·2	109·1	116·3	123·7	131·3
140	74·0	79·8	85·9	92·1	98·6	105·2	112·2	119·3	126·6
145	71·5	77·1	82·9	88·9	95·2	101·6	108·3	115·2	122·2
150	69·1	74·5	80·1	86·0	92·0	98·2	104·7	111·3	118·2
155	66·9	72·1	77·5	83·2	89·0	95·1	101·3	107·7	114·4
160	64·8	69·8	75·1	80·6	86·2	92·1	98·1	104·4	110·8

* 5000 lbs. per square inch of net section is the greatest working stress to which iron stays, which have been welded or worked in the fire, should be subjected.

Stress on Iron Stay, 5000 lbs. per square inch of net section.*

Pressure per square inch.	Area 3·7583 sq. ins.	Area 3·9761 sq. ins.	Area 4·2000 sq. ins.	Area 4·4301 sq. ins.	Area 4·6664 sq. ins.	Area 4·9087 sq. ins.	Area 5·1572 sq. ins.	Area 5·4119 sq. ins.	Area 5·6727 sq. ins.
	Diam. $2\frac{3}{16}$ inches.	Diam. $2\frac{1}{4}$ inches.	Diam. $2\frac{5}{16}$ inches.	Diam. $2\frac{3}{8}$ inches.	Diam. $2\frac{7}{16}$ inches.	Diam. $2\frac{1}{2}$ inches.	Diam. $2\frac{9}{16}$ inches.	Diam $2\frac{5}{8}$ inches.	Diam. $2\frac{11}{16}$ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	939·5	994·0	...	...	...	...	...	...	...
25	751·6	795·2	840·0	886·0	933·2	981·7	...	...	...
30	626·3	662·6	700·0	738·3	777·7	818·1	859·5	901·9	945·4
35	536·9	568·0	600·0	632·8	666·6	701·2	736·7	773·1	810·3
40	469·7	497·0	525·0	553·7	583·3	613·5	644·6	676·4	709·0
45	417·5	441·7	466·6	492·2	518·4	545·4	573·0	601·3	630·3
50	375·8	397·6	420·0	443·0	466·6	490·8	515·7	541·1	567·2
55	341·6	361·4	381·8	402·7	424·2	446·2	468·8	491·9	515·7
60	313·1	331·3	350·0	369·1	388·8	409·0	429·7	450·9	472·7
65	289·0	305·8	323·0	340·7	358·9	377·5	396·7	416·3	436·3
70	268·4	284·0	300·0	316·4	333·3	350·6	368·3	386·5	405·1
75	250·5	265·0	280·0	295·3	311·0	327·2	343·8	360·7	378·1
80	234·8	248·5	262·5	276·8	291·6	306·7	322·3	338·2	354·5
85	221·0	233·8	247·0	260·6	274·4	288·7	303·3	318·3	333·6
90	208·7	220·8	233·3	246·1	259·2	272·7	286·5	300·6	315·1
95	197·8	209·2	221·0	233·1	245·6	258·3	271·4	284·8	298·5
100	187·9	198·8	210·0	221·5	233·3	245·4	257·8	270·5	283·6
105	178·9	189·3	200·0	210·9	222·2	233·7	245·5	257·7	270·1
110	170·8	180·7	190·9	201·3	212·1	223·1	234·4	245·9	257·8
115	163·4	172·8	182·6	192·6	202·8	213·4	224·2	235·3	246·6
120	156·5	165·6	175·0	184·5	194·4	204·5	214·8	225·4	236·3
125	150·3	159·0	168·0	177·2	186·6	196·3	206·2	216·4	226·9
130	144·5	152·9	161·5	170·3	179·4	188·7	198·3	208·1	218·1
135	139·1	147·2	155·5	164·0	172·8	181·8	191·0	200·4	210·1
140	134·2	142·0	150·0	158·2	166·6	175·3	184·1	193·2	202·5
145	129·5	137·1	144·8	152·7	160·9	169·2	177·8	186·6	195·6
150	125·2	132·5	140·0	147·6	155·5	163·6	171·9	180·3	189·0
155	121·2	128·2	135·4	142·9	150·5	158·3	166·3	174·5	182·9
160	117·4	124·2	131·2	138·4	145·8	153·3	161·1	169·1	177·2

* 5000 lbs. per square inch of net section is the greatest working stress to which iron stays, which have been welded or worked in the fire, should be subjected.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

TABLE No. 35.

Stress on Iron Stay, 5000 lbs. per square inch of net section.*

Pressure per square inch.	Area 5·9396 sq. ins.	Area 6·2126 sq. ins.	Area 6·4918 sq. ins.	Area 6·7771 sq. ins.	Area 7·0686 sq. ins.	Area 7·3662 sq. ins.	Area 7·6699 sq. ins.	Area 7·9798 sq. ins.	Area 8·2958 sq. ins.
	Diam. $2\frac{3}{4}$ inches.	Diam. $2\frac{13}{16}$ inches.	Diam. $2\frac{7}{8}$ inches.	Diam. $2\frac{15}{16}$ inches.	Diam. 3 inches.	Diam. $3\frac{1}{16}$ inches.	Diam. $3\frac{1}{8}$ inches.	Diam. $3\frac{3}{16}$ inches.	Diam. $3\frac{1}{4}$ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...
30	989·9	...	...	...	...	...	...	...	...
35	848·5	887·5	927·4	968·1	...	...	...	...	...
40	742·4	776·5	811·4	847·1	883·5	920·7	958·7	997·4	...
45	659·9	690·2	721·3	753·0	785·4	818·4	852·2	886·6	921·7
50	593·9	621·2	649·1	677·7	706·8	736·6	766·9	797·9	829·5
55	539·9	564·7	590·1	616·1	642·6	669·6	697·2	725·4	754·1
60	494·9	517·7	540·9	564·7	589·0	613·8	639·1	664·9	691·3
65	456·8	477·8	499·3	521·3	543·7	566·6	589·9	613·8	638·1
70	424·2	443·7	463·7	484·0	504·9	526·1	547·8	569·9	592·5
75	395·9	414·1	432·7	451·8	471·2	491·0	511·3	531·9	553·0
80	371·2	388·2	405·7	423·5	441·7	460·3	479·3	498·7	518·4
85	349·3	365·4	381·8	398·6	415·8	433·3	451·1	469·4	487·9
90	329·9	345·1	360·6	376·5	392·7	409·2	426·1	443·3	460·8
95	312·6	326·9	341·6	356·6	372·0	387·6	403·6	419·9	436·6
100	296·9	310·6	324·5	338·8	353·4	368·3	383·4	398·9	414·7
105	282·8	295·8	309·1	322·7	336·6	350·7	366·5	379·9	395·0
110	269·9	282·3	295·0	308·0	321·3	334·8	348·6	362·7	377·0
115	258·2	270·1	282·2	294·6	307·3	320·2	333·4	346·9	360·6
120	247·4	258·8	270·4	282·3	294·5	306·9	319·5	332·4	345·6
125	237·5	248·5	259·6	271·0	282·7	294·6	306·7	319·1	331·8
130	228·4	238·9	249·6	260·6	271·8	283·3	294·9	306·9	319·0
135	219·9	230·0	240·4	251·0	261·8	272·8	284·0	295·5	307·2
140	212·1	221·8	231·8	242·0	252·4	263·0	273·9	284·9	296·2
145	204·8	214·2	223·8	233·6	243·7	254·0	264·4	275·1	286·0
150	197·9	207·0	216·3	225·9	235·6	245·5	255·6	265·9	276·5
155	191·5	200·4	209·4	218·6	228·0	237·6	247·4	257·4	267·6
160	185·6	194·1	202·8	211·7	220·8	230·1	239·6	249·3	259·2

* 5000 lbs. per square inch of net section is the greatest working stress to which iron stays, which have been welded or worked in the fire, should be subjected.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.

The following notes will facilitate the use of the Tables which immediately follow, numbered 36 to 40 and Nos. 257 to 259.

(1) If the working pressure be 140 lbs., the surface to be supported by one stay 210 square inches, and the size of stay be required :—

Then, opposite 140 lbs. in Table No. 39, the surface 210 square inches is found under the diameter $2\frac{5}{16}$ inches and area 4·2 square inches, which is the size of stay required.

(2) If the surface be 138 square inches, the stay $1\frac{7}{8}$ inch diameter, area 2·7612 square inches, and the working pressure be required :—

Then, in Table No. 38, $1\frac{7}{8}$ diameter stay is found, and in the column under the area 2·7612 square inches, and $1\frac{7}{8}$ inch diameter, the surface is 138 square inches, and opposite it the pressure is 140 lbs. ; this is the working pressure suitable.

(3) If the stay be 1 inch diameter, the area ·7854 square inch, the working pressure 80 lbs., and the greatest surface for such size of stay and working pressure be required :—

Then, in Table No. 36, 1 inch stay is found, and opposite 80 lbs. in the column for 1 inch diameter, area ·7854 inch, the surface is 68·7 square inches; this is the surface suitable for such stay and pressure.

When the surface is not found opposite the pressure, it will be on the side of safety to adopt the larger size of stay over the next greater surface on the right.

The diameter is always the net effective diameter, or diameter at the bottom of the thread, and the area the net sectional area at the smallest part of the stay.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.*

Pressure per square inch.	Area 0·1963 sq. inch.	Area 0·2485 sq. inch.	Area 0·3068 sq. inch.	Area 0·3712 sq. inch.	Area 0·4417 sq. inch.	Area 0·5184 sq. inch.	Area 0·6013 sq. inch.	Area 0·6902 sq. inch.	Area 0·7854 sq. inch.
	Diam. ½ inch.	Diam. 9/16 inch.	Diam. ⅝ inch.	Diam. 11/16 inch.	Diam. ¾ inch.	Diam. 13/16 inch.	Diam. ⅞ inch.	Diam. 15/16 inch.	Diam. 1 inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	274·8	347·9	429·5	519·6	618·3	725·7	841·8	966·2	...
10	137·4	173·9	214·7	259·8	309·1	362·8	420·9	483·1	549·7
15	91·6	115·9	143·1	173·2	206·1	241·9	280·6	322·0	366·5
20	68·7	86·9	107·3	129·9	154·5	181·4	210·4	241·5	274·8
25	54·9	69·5	85·9	103·9	123·6	145·1	168·3	193·2	219·9
30	45·8	57·9	71·5	86·6	103·0	120·9	140·3	161·0	183·2
35	39·2	49·7	61·3	74·2	88·3	103·6	120·2	138·0	157·0
40	34·3	43·4	53·6	64·9	77·2	90·7	105·2	120·7	137·4
45	30·5	38·6	47·7	57·7	68·7	80·6	93·5	107·3	122·1
50	27·4	34·7	42·9	51·9	61·8	72·5	84·1	96·6	109·9
55	24·9	31·6	39·0	47·2	56·2	65·9	76·5	87·8	99·9
60	22·9	28·9	35·7	43·3	51·5	60·4	70·1	80·5	91·6
65	21·1	26·7	33·0	39·9	47·5	55·8	64·7	74·3	84·5
70	19·6	24·8	30·6	37·1	44·1	51·8	60·1	69·0	78·5
75	18·3	23·1	28·6	34·6	41·2	48·3	56·1	64·4	73·3
80	17·1	21·7	26·8	32·4	38·6	45·3	52·6	60·4	68·7
85	16·1	20·4	25·2	30·5	36·3	42·7	49·5	56·8	64·6
90	15·2	19·3	23·8	28·8	34·3	40·3	46·7	53·6	61·0
95	14·4	18·3	22·6	27·3	32·5	38·2	44·3	50·8	57·8
100	13·7	17·3	21·4	25·9	30·9	36·2	42·0	48·3	54·9
105	13·0	16·5	20·4	24·7	29·4	34·5	40·0	46·0	52·3
110	12·4	15·8	19·5	23·6	28·1	32·9	38·2	43·9	49·9
115	...	15·1	18·6	22·5	26·8	31·5	36·6	42·0	47·8
120	...	14·4	17·8	21·6	25·7	30·2	35·0	40·2	45·8
125	...	13·9	17·1	20·7	24·7	29·0	33·6	38·6	43·9
130	...	13·3	16·5	19·9	23·7	27·9	32·3	37·1	42·2
135	...	12·8	15·9	19·2	22·9	26·8	31·1	35·7	40·7
140	...	12·4	15·3	18·5	22·0	25·9	30·0	34·5	39·2
145	...	...	14·8	17·9	21·3	25·0	29·0	33·3	37·9
150	...	...	14·3	17·3	20·6	24·1	28·0	32·2	36·6
155	...	...	13·8	16·7	19·9	23·4	27·1	31·1	35·4
160	...	...	13·4	16·2	19·3	22·6	26·3	30·2	34·3

* 7000 lbs. per square inch of net section is the greatest working stress to which *solid* iron screwed stays, which have *not* been welded or worked in the fire, should be subjected.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.*

Pressure per square inch.	Area 0·8866 sq. inch. Diam. $1\frac{1}{16}$ inch.	Area 0·9940 sq. inch. Diam. $1\frac{1}{8}$ inch.	Area 1·1075 sq. inch. Diam. $1\frac{3}{16}$ inch.	Area 1·2272 sq. inch. Diam. $1\frac{1}{4}$ inch.	Area 1·3530 sq. inch. Diam. $1\frac{5}{16}$ inch.	Area 1·4849 sq. inch Diam. $1\frac{3}{8}$ inch.	Area 1·6230 sq. inch. Diam. $1\frac{7}{16}$ inch.	Area 1·7671 sq. inch. Diam. $1\frac{1}{2}$ inch.	Area 1·9175 sq. inch. Diam $1\frac{9}{16}$ inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	620·6	695·8	775·2	859·0	947·0	...	...	...	...
15	413·7	463·8	516·8	572·6	631·4	692·9	757·4	824·6	894·8
20	310·3	347·9	387·6	429·5	473·5	519·7	568·0	618·4	671·1
25	248·2	278·3	310·1	343·6	378·8	415·7	454·4	494·7	536·9
30	206·8	231·9	258·4	286·3	315·7	346·4	378·7	412·3	447·4
35	177·3	198·8	221·5	245·4	270·5	296·9	324·6	353·4	383·5
40	155·1	173·9	193·8	214·7	236·7	259·8	284·0	309·2	335·5
45	137·9	154·6	172·2	190·8	210·4	230·9	252·4	274·8	298 2
50	124·1	139·1	155·0	171·8	189·4	207·8	227·2	247·3	268·4
55	112·8	126·5	140·9	156·1	172·1	188·9	206·5	224·9	244·0
60	103·4	115·9	129·2	143·1	157·8	173·2	189·3	206·1	223·7
65	95·4	107·0	119·2	132·1	145·6	159·9	174·7	190·3	206·5
70	88·6	99·4	110·7	122·7	135·2	148·4	162·2	176·7	191·7
75	82·7	92·7	103·3	114·5	126·2	138·5	151·4	164·9	178·9
80	77·5	86·9	96·9	107·3	118·3	129·9	142·0	154·6	167·7
85	73·0	81·8	91·2	101·0	111·4	122·2	133·6	145·5	157·9
90	68·9	77·3	86·1	95·4	105·2	115·4	126·2	137·4	149·1
95	65·3	73·2	81·6	90·4	99·6	109·4	119·5	130·2	141·2
100	62·0	69·5	77·5	85·9	94·7	103·9	113·6	123·6	134·2
105	59·1	66·2	73·8	81·8	90·1	98·9	108·1	117 8	127·8
110	56·4	63·2	70·4	78·0	86·0	94·4	103·2	112·4	122·0
115	53·9	60·5	67·4	74·6	82·3	90·3	98·7	107·5	116·7
120	51·7	57·9	64·6	71·5	78·9	86·6	94·6	103·0	111·8
125	49·6	55·6	62·0	68·7	75·7	83·1	90·8	98·9	107·3
130	47·7	53·5	59·6	66·0	72·8	79·9	87·3	95·1	103·2
135	45·9	51·5	57·5	63·6	70·1	76·9	84·1	91·6	99·4
140	44·3	49·7	55·3	61·3	67·6	74·2	81·1	88·3	95·8
145	42·8	47·9	53·4	59·2	65·3	71·6	78·3	85·3	92·5
150	41·3	46·3	51·6	57·2	63·1	69·2	75·7	82·4	89·4
155	40·0	44·8	50·0	55·4	61·0	67·0	73·2	79·8	86·5
160	38·7	43·4	48·4	53·6	59·1	64·9	71·0	77·3	83·8

* 7000 lbs. per square inch of net section is the greatest working stress to which *solid* iron screwed stays, which have *not* been welded or worked in the fire, should be subjected.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

TABLE No. 38.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.*

Pressure per square inch.	Area 2·0739 sq. ins.	Area 2·2365 sq. ins.	Area 2·4053 sq. ins.	Area 2·5802 sq. ins.	Area 2·7612 sq. ins.	Area 2·9483 sq. ins.	Area 3·1416 sq. ins.	Area 3·3410 sq. ins.	Area 3·5466 sq. ins.
	Diam. 1⅝ inch.	Diam. 1 11/16 inch.	Diam. 1¾ inch.	Diam. 1 13/16 inch.	Diam. 1⅞ inch.	Diam. 1 15/16 inch.	Diam. 2 inches.	Diam. 2 1/16 inches.	Diam. 2⅛ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	..	...	...	...
10	...	...	...	...	...	...	...	...	...
15	967·8	...	...	...	...	...	...	...	...
20	725·8	782·7	841·8	903·0	966·4	...	...	...	..
25	580·6	626·2	673·4	722·4	773·1	825·5	879·6	935·4	993·0
30	483·9	521·8	561·2	602·0	644·2	687·9	733·0	779·5	827·5
35	414·7	447·3	481·0	516·0	552·2	589·6	628·3	668·2	709·3
40	362·9	391·3	420·9	451·5	483·2	515·9	549·7	584·6	620·6
45	322·6	347·9	374·1	401·3	429·5	458·6	488·6	519·7	551·6
50	290·3	313·1	336·7	361·2	386·5	412·7	439·8	467·7	496·5
55	263·9	284·6	306·1	328·3	351·4	375·2	399·8	425·2	451·3
60	241·9	260·9	280·6	301·0	322·1	343·9	366·5	389·7	413·7
65	223·3	240·8	259·0	277·8	297·3	317·5	338·3	359·8	381·9
70	207·3	223·6	240·5	258·0	276·1	294·8	314·1	334·1	354·6
75	193·5	208·7	224·4	240·8	257·7	275·1	293·2	311·8	331·0
80	181·4	195·6	210·4	225·7	241·6	257·9	274·8	292·3	310·3
85	170·7	184·1	198·0	212·4	227·3	242·8	258·7	275·1	292·0
90	161·3	173·9	187·0	200·6	214·7	229·3	244·3	259·8	275·8
95	152·8	164·7	177·2	190·1	203·4	217·2	231·4	246·1	261·3
100	145·1	156·5	168·3	180·6	193·2	206·3	219·9	233·8	248·2
105	138·2	149·1	160·3	172·0	184·0	196·5	209·4	222·7	236·4
110	131·9	142·3	153·0	164·1	175·7	187·6	199·9	212·6	225·6
115	126·2	136·1	146·4	157·0	168·0	179·4	191·2	203·3	215·8
120	120·9	130·4	140·3	150·5	161·0	171·9	183·2	194·8	206·8
125	116·1	125·2	134·6	144·4	154·6	165·1	175·9	187·1	198·6
130	111·6	120·4	129·5	138·9	148·6	158·7	169·1	179·9	190·9
135	107·5	115·9	124·7	133·7	143·1	152·8	162·8	173·2	183·8
140	103·6	111·8	120·2	129·0	138·0	147·4	157·0	167·0	177·3
145	100·1	107·9	116·1	124·5	133·2	142·3	151·6	161·2	171·2
150	96·7	104·3	112·2	120·4	128·8	137·5	146·6	155·9	165·5
155	93·6	101·0	108·6	116·5	124·6	131·1	141·8	150·8	160·1
160	90·7	97·8	105·2	112·8	120·7	128·9	137·4	146·1	155·1

* 7000 lbs. per square inch of net section is the greatest working stress to which *solid* iron screwed stays, which have *not* been welded or worked in the fire, should be subjected.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

TABLE No. 39.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.*

Pressure per square inch.	Area 3·7583 sq. ins.	Area 3·9761 sq. ins.	Area 4·2000 sq. ins.	Area 4·4301 sq. ins.	Area 4·6664 sq. ins.	Area 4·9087 sq. ins.	Area 5·1572 sq. ins.	Area 5·4119 sq. ins.	Area 5·6727 sq. ins.
	Diam. $2\frac{3}{16}$ inches.	Diam. $2\frac{1}{4}$ inches.	Diam. $2\frac{5}{16}$ inches.	Diam. $2\frac{3}{8}$ inches.	Diam. $2\frac{7}{16}$ inches.	Diam. $2\frac{1}{2}$ inches.	Diam. $2\frac{9}{16}$ inches.	Diam. $2\frac{5}{8}$ inches.	Diam. $2\frac{11}{16}$ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...
30	876·9	927·7	980·0	...	...	...	...	...	...
35	751·6	795·2	840·0	886·0	933·2	981·7	...	...	...
40	657·7	695·8	735·0	775·2	816·6	859·0	902·5	947·0	992·7
45	584·6	618·4	653·3	689·1	725·8	763·5	802·2	841·8	882·4
50	526·1	556·6	588·0	620·2	653·2	687·2	722·0	757·6	794·1
55	478·3	506·0	534·5	563·8	593·9	624·7	656·3	688·7	721·9
60	438·4	463·8	490·0	516·8	544·4	572·6	601·6	631·3	661·8
65	404·7	428·1	452·3	477·0	502·5	528·6	555·3	582·8	610·9
70	375·8	397·6	420·0	443·0	466·6	490·8	515·7	541·1	567·2
75	350·7	371·0	392·0	413·4	435·5	458·1	481·3	505·1	529·4
80	328·8	347·9	367·5	387·6	408·3	429·5	451·2	473·5	496·3
85	309·5	327·4	345·8	364·8	384·2	404·2	424·7	445·6	467·1
90	292·3	309·2	326·6	344·5	362·9	381·7	401·1	420·9	441·2
95	276·9	292·9	309·4	326·4	343·8	361·6	380·0	398·7	417·9
100	263·0	278·3	294·0	310·1	326·6	343·6	361·0	378·8	397·0
105	250·5	265·0	280·0	295·3	311·0	327·2	343·8	360·7	378·1
110	239·1	253·0	267·2	281·9	296·9	312·3	328·1	344·3	360·9
115	228·7	242·0	255·6	269·6	284·0	298·7	313·9	329·4	345·2
120	219·2	231·9	245·0	258·4	272·2	286·3	300·8	315·6	330·9
125	210·4	222·6	235·2	248·0	261·3	274·8	288·8	303·0	317·6
130	202·3	214·0	226·1	238·5	251·2	264·3	277·7	291·4	305·4
135	194·8	206·1	217·7	229·7	241·9	254·5	267·4	280·6	294·1
140	187·9	198·8	210·0	221·5	233·3	245·4	257·8	270·5	283·6
145	181·4	191·9	202·7	213·8	225·2	236·9	248·9	261·2	273·8
150	175·3	185·5	196·0	206·7	217·7	229·0	240·6	252·5	264·7
155	169·7	179·5	189·6	200·0	210·7	221·6	232·9	244·4	256·1
160	164·4	173·9	183·7	193·8	204·1	214·7	220·6	236·7	248·1

* 7000 lbs. per square inch of net section is the greatest working stress to which *solid* iron screwed stays, which have *not* been welded or worked in the fire, should be subjected.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.*

Pressure per square inch.	Area 5·9396 sq. ins.	Area 6·2126 sq. ins.	Area 6·4918 sq. ins.	Area 6·7771 sq. ins.	Area 7·0686 sq. ins.	Area 7·3662 sq. ins.	Area 7·6699 sq. ins.	Area 7·9798 sq. ins.	Area 8·2958 sq. ins.
	Diam. 2¾ inches.	Diam. 2$\frac{13}{16}$ inches.	Diam. 2⅞ inches.	Diam. 2$\frac{15}{16}$ inches.	Diam. 3 inches.	Diam. 3$\frac{1}{16}$ inches.	Diam. 3⅛ inches.	Diam. 3$\frac{3}{16}$ inches.	Diam. 3¼ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...
45	923·9	966·4	...	...	...	...	...	...	...
50	831·5	869·7	908·8	948·7	989·6	...	...	...	...
55	755·9	790·6	826·2	862·5	899·6	937·5	976·1	...	...
60	692·9	724·8	757·3	790·6	824·6	859·3	894·8	930·9	967·8
65	639·6	669·0	699·1	729·8	761·2	793·2	825·9	859·3	893·3
70	593·9	621·2	649·1	677·7	706·8	736·6	766·9	797·9	829·5
75	554·3	579·8	605·9	632·5	659·7	687·5	715·8	744·7	774·2
80	519·7	543·6	568·0	593·0	618·5	644·5	671·1	698·2	725·8
85	489·1	511·6	534·6	558·1	582·1	606·6	631·6	657·1	683·1
90	461·9	483·2	504·9	527·1	549·7	572·9	596·5	620·6	645·2
95	437·6	457·7	478·3	499·3	520·8	542·7	565·1	587·9	611·2
100	415·7	434·8	454·4	474·3	494·8	515·6	536·8	558·5	580·7
105	395·9	414·1	432·7	451·8	471·2	491·0	511·2	531·9	553·0
110	377·9	395·3	413·1	431·2	449·8	468·7	488·0	507·7	527·9
115	361·5	378·1	395·1	412·5	430·2	448·3	466·8	485·7	504·9
120	346·4	362·4	378·6	395·3	412·3	429·6	447·4	465·4	483·9
125	332·6	347·9	363·5	379·5	395·8	412·5	429·5	446·8	464·5
130	319·8	334·5	349·5	364·9	380·6	396·6	412·9	429·6	446·6
135	307·9	322·1	336·6	351·4	366·5	381·9	397·6	413·7	430·1
140	296·9	310·6	324·5	338·8	353·4	368·3	383·4	398·9	414·7
145	286·7	299·9	313·3	327·1	341·2	355·6	370·2	385·2	400·4
150	277·1	289·9	302·9	316·2	329·8	343·7	357·9	372·3	387·1
155	268·2	280·5	293·1	306·0	319·2	332·6	346·3	360·3	374·6
160	259·8	271·8	284·0	296·5	309·7	322·2	335·5	349·1	362·9

* 7000 lbs. per square inch of net section is the greatest working stress to which *solid* iron screwed stays, which have *not* been welded or worked in the fire, should be subjected.

IRON GIRDERS FOR FLAT SURFACES.

The following notes will facilitate the use of the Tables, numbered from 41 to 51, which immediately follow, and Nos. 260 to 270.

W = Width of combustion box, in inches.
D = Distance between centres of girders, in inches.
P = Pitch of supporting bolts, in inches.
N = Number of supporting bolts in a girder.

When the number of supporting bolts in a girder is *odd*, the number in the Table under the particular depth of girder is the maximum value that $W^2 \times D$ may have for the particular working pressure opposite to it in column 1.

When the number of supporting bolts in a girder is *even*, the number in the Table under the particular depth of girder is the maximum value that $(W^2 - P^2)D$ may have for the particular working pressure opposite to it in column 1.

(1) If the working pressure is required when the width of the box, the distance between centres of girders, the pitch of supporting bolts, the number of supporting bolts in the girder, and the dimensions of girder are known :—

If the width, W, of the combustion box be 28 inches, the number, N, of bolts 3 (which is an *odd* number), the distance, D, between the centres of the girders 7 inches, and the dimensions of the girder 6 inches deep by 1 inch thick :—

Then, $W^2 \times D$ or $28^2 \times 7 = 5488$. This number is not found in the Table, it being between 5400 and 5760 (see Table No. 45 for Iron Plates 1 inch thick), but by the note at the foot of the Tables, when the exact number is not found, the next *higher* number should be taken ; hence the pressure opposite 5760, the next *higher* number, being 75 lbs., is the working pressure obtained. When the difference is very little, however, as it is in this case, between 5488 and 5400, the pressure opposite the *lower* number may be used ; therefore, 80 lbs. may be adopted as the working pressure.

(2) When the depth of girder necessary for a given working pressure and thickness of girder is required :—

If the width, W, of the combustion box be 24 inches, the number, N, of supporting bolts 2 (which is an *even* number), the distance, D, between the centres of the girders 8¾ inches, the pitch of the supporting bolts 8 inches, the thickness of the girders 1 inch, and the working pressure 80 lbs. :—

Then, $(W^2 - P^2)D$ or $(24^2 - 8^2)\ 8\frac{3}{4} = 4480$ and opposite 80 lbs. working pressure in column 1, the number 4537 is found (see Table No. 45 for Iron Plates 1 inch thick), which is the next

greater number to 4480, and at the head of column over 4537 will be found 5½ inches, the depth of girder necessary.

P may in all cases be found by dividing W, the width of the combustion box, by N, the number of supporting bolts in the girder, *plus* 1, or $\frac{W}{N+1} = P$ in all cases.

D, when the number of supporting bolts is *odd*, may be found by dividing the number in the Table opposite the given working pressure by W^2.

When the number of supporting bolts is *even*, D can be found by dividing the number in the Table opposite the given working pressure by $W^2 - P^2$.

The working pressure and the thickness of plate regulate P, the pitch, and D, the distance between the centres of girders; and the surface due to $P \times D$ should be regulated by the Tables for Iron Plates (Pitches, Surfaces, and Pressures). The girders should be so proportioned as to be effective for the pressure, pitch of supporting bolts, number of supporting bolts in a girder, and the distance between the centres of girders. By the following Tables the dimensions of iron girders can be fixed, or the working pressure suitable for any given wrought iron girder ascertained.

The thicknesses in the Tables are the total thicknesses whether the girders be solid or formed of two plates.

Pressure per sq. in.	Depths of Girders in inches.								
	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
lbs. 5	3675	4800	6075	7500	9075	10800	12675	14700	16875
10	1837	2400	3037	3750	4537	5400	6337	7350	8437
15	1225	1600	2025	2500	3025	3600	4225	4900	5625
20	918	1200	1518	1875	2268	2700	3168	3675	4218
25	735	960	1215	1500	1815	2160	2535	2940	3375
30	612	800	1012	1250	1512	1800	2112	2450	2812
35	525	685	867	1071	1296	1542	1810	2100	2410
40	...	600	759	937	1134	1350	1584	1837	2109
45	...	533	675	833	1008	1200	1408	1633	1875
50	...	...	607	750	907	1080	1267	1470	1687
55	...	...	552	681	825	981	1152	1336	1534
60	...	...	506	625	756	900	1056	1225	1406
65	...	...	...	576	698	830	975	1130	1298
70	...	...	...	535	648	771	905	1050	1205
75	...	...	...	500	605	720	845	980	1125
80	...	...	...	...	567	675	792	918	1054
85	...	...	...	...	533	635	745	864	992
90	...	...	...	...	504	600	704	816	937
95	...	...	...	...	...	568	667	773	888
100	...	...	...	...	...	540	633	735	843
105	...	...	...	...	...	514	603	700	803
110	...	...	...	...	...	...	576	668	767
115	...	...	...	...	...	...	551	639	733
120	...	...	...	...	...	...	528	612	703
125	...	...	...	...	...	...	507	588	675
130	...	...	...	...	...	...	...	565	649
135	...	..	...	...	...	...	...	544	625
140	...	...	...	...	...	...	...	525	602
145	...	..	...	...	...	...	...	506	581
150	...	...	...	...	...	...	...	...	562
155	...	...	...	..	..	...	...	...	544
160	...	...	...	...	..	...	...	...	527

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼
lbs.									
5	7593	9375	11343	13500	15843	18375	21093	24000	27093
10	3796	4687	5671	6750	7921	9187	10546	12000	13546
15	2531	3125	3781	4500	5281	6125	7031	8000	9031
20	1898	2343	2835	3375	3960	4593	5273	6000	6773
25	1518	1875	2268	2700	3168	3675	4218	4800	5418
30	1265	1562	1890	2250	2640	3062	3515	4000	4515
35	1084	1339	1620	1928	2263	2625	3013	3428	3870
40	949	1171	1417	1687	1980	2296	2636	3000	3386
45	843	1041	1260	1500	1760	2041	2343	2666	3010
50	759	937	1134	1350	1584	1837	2109	2400	2709
55	690	852	1031	1227	1440	1670	1917	2181	2463
60	632	781	945	1125	1320	1531	1757	2000	2257
65	584	721	872	1038	1218	1413	1622	1846	2084
70	542	669	810	964	1131	1312	1506	1714	1935
75	506	625	756	900	1056	1225	1406	1600	1806
80	...	585	708	843	990	1148	1318	1500	1693
85	...	551	667	794	931	1080	1240	1411	1593
90	...	520	630	750	880	1020	1171	1333	1505
95	...	...	597	710	833	967	1110	1263	1425
100	...	...	567	675	792	918	1054	1200	1354
105	...	...	540	642	754	875	1004	1142	1290
110	...	...	515	613	720	835	958	1090	1231
115	..	...	...	586	688	798	917	1043	1177
120	...	...	...	562	660	765	878	1000	1128
125	...	...	...	540	633	735	843	960	1083
130	...	...	...	519	609	706	811	923	1042
135	...	...	...	500	586	680	781	888	1003
140	...	...	...	...	565	656	753	857	967
145	...	...	...	...	546	633	727	827	934
150	...	...	...	...	528	612	703	800	903
155	...	...	...	...	511	592	680	774	873
160	...	...	...	...	...	574	659	750	846

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾
lbs. 5	13612	16200	19012	22050	25312	28800	32512	36450	40612
10	6806	8100	9506	11025	12656	14400	16256	18225	20306
15	4537	5400	6337	7350	8437	9600	10837	12150	13537
20	3403	4050	4753	5512	6328	7200	8128	9112	10153
25	2722	3240	3802	4410	5062	5760	6502	7290	8122
30	2268	2700	3168	3675	4218	4800	5418	6075	6768
35	1944	2314	2716	3150	3616	4114	4644	5207	5801
40	1701	2025	2376	2756	3164	3600	4064	4556	5076
45	1512	1800	2112	2450	2812	3200	3612	4050	4512
50	1361	1620	1901	2205	2531	2880	3251	3645	4061
55	1237	1472	1728	2004	2301	2618	2955	3313	3692
60	1134	1350	1584	1837	2109	2400	2709	3037	3384
65	1047	1246	1462	1696	1947	2215	2500	2803	3124
70	972	1157	1358	1575	1808	2057	2322	2603	2900
75	907	1080	1267	1470	1687	1920	2167	2430	2707
80	850	1012	1188	1378	1582	1800	2032	2278	2538
85	800	952	1118	1297	1488	1694	1912	2144	2388
90	756	900	1056	1225	1406	1600	1806	2025	2256
95	716	852	1000	1160	1332	1515	1711	1918	2137
100	680	810	950	1102	1265	1440	1625	1822	2030
105	648	771	905	1050	1205	1371	1548	1735	1933
110	618	736	864	1002	1150	1309	1477	1656	1846
115	591	704	826	958	1100	1252	1413	1584	1765
120	567	675	792	918	1054	1200	1354	1518	1692
125	544	648	760	882	1012	1152	1300	1458	1624
130	523	623	731	848	973	1107	1250	1401	1562
135	504	600	704	816	937	1066	1204	1350	1504
140	...	578	679	787	904	1028	1161	1301	1450
145	...	558	655	760	872	993	1121	1256	1400
150	...	540	633	735	843	960	1083	1215	1353
155	...	522	613	711	816	929	1048	1175	1310
160	...	506	594	689	791	900	1016	1139	1269

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2-P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	3½	3¾	4	4¼	4½	4¾	5	5¼	5½
lbs. 5	25725	29531	33600	37931	42525	47381	...	...	...
10	12862	14765	16800	18965	21262	23690	26250	28940	31762
15	8575	9843	11200	12643	14175	15793	17500	19293	21175
20	6431	7382	8400	9482	10631	11845	13125	14470	15881
25	5145	5906	6720	7586	8505	9476	10500	11576	12705
30	4287	4921	5600	6321	7087	7896	8750	9646	10587
35	3675	4218	4800	5418	6075	6768	7500	8268	9075
40	3215	3691	4200	4741	5315	5922	6562	7235	7940
45	2858	3281	3733	4214	4725	5264	5833	6431	7058
50	2572	2953	3360	3793	4252	4738	5250	5788	6352
55	2338	2684	3054	3448	3865	4307	4772	5261	5775
60	2143	2460	2800	3160	3543	3948	4375	4823	5293
65	1978	2271	2584	2917	3271	3644	4038	4452	4886
70	1837	2109	2400	2709	3037	3384	3750	4134	4537
75	1715	1968	2240	2528	2835	3158	3500	3858	4235
80	1607	1845	2100	2370	2657	2961	3281	3617	3970
85	1513	1737	1976	2231	2501	2787	3088	3404	3736
90	1429	1640	1866	2107	2362	2632	2916	3215	3529
95	1353	1554	1768	1996	2238	2493	2763	3046	3343
100	1286	1476	1680	1896	2126	2369	2625	2894	3176
105	1225	1406	1600	1806	2025	2256	2500	2756	3025
110	1169	1342	1527	1724	1932	2153	2386	2630	2887
115	1118	1283	1460	1649	1848	2060	2282	2516	2761
120	1071	1230	1400	1580	1771	1974	2187	2411	2646
125	1029	1181	1344	1517	1701	1895	2100	2315	2541
130	989	1135	1292	1458	1635	1822	2019	2226	2443
135	952	1093	1244	1404	1575	1754	1944	2143	2352
140	918	1054	1200	1354	1518	1692	1875	2067	2268
145	887	1018	1158	1307	1466	1633	1810	1995	2190
150	857	984	1120	1264	1417	1579	1750	1929	2117
155	829	952	1083	1223	1371	1528	1693	1867	2049
160	803	922	1050	1185	1328	1480	1640	1808	1985

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼
lbs.									
5	43350	48600	...	...	...	...	...	...	...
10	21675	24300	27075	30000	33075	36300	39675	43200	46875
15	14450	16200	18050	20000	22050	24200	26450	28800	31250
20	10837	12150	13537	15000	16537	18150	19837	21600	23437
25	8670	9720	10830	12000	13230	14520	15870	17280	18750
30	7225	8100	9025	10000	11025	12100	13225	14400	15625
35	6192	6942	7735	8571	9450	10371	11335	12342	13392
40	5418	6075	6768	7500	8268	9075	9918	10800	11718
45	4816	5400	6016	6666	7350	8066	8816	9600	10416
50	4335	4860	5415	6000	6615	7260	7935	8640	9375
55	3940	4418	4922	5454	6013	6600	7213	7854	8522
60	3612	4050	4512	5000	5512	6050	6612	7200	7812
65	3334	3738	4165	4615	5088	5584	6103	6646	7211
70	3096	3471	3867	4285	4725	5185	5667	6171	6696
75	2890	3240	3610	4000	4410	4840	5290	5760	6250
80	2709	3037	3384	3750	4134	4537	4959	5400	5859
85	2550	2858	3185	3529	3891	4270	4667	5082	5514
90	2408	2700	3008	3333	3675	4033	4408	4800	5208
95	2281	2557	2850	3157	3481	3821	4176	4547	4934
100	2167	2430	2707	3000	3307	3630	3967	4320	4687
105	2064	2314	2578	2857	3150	3457	3778	4114	4464
110	1970	2209	2461	2727	3006	3300	3606	3927	4261
115	1884	2113	2354	2608	2876	3156	3450	3756	4076
120	1806	2025	2256	2500	2756	3025	3306	3600	3906
125	1734	1944	2166	2400	2646	2904	3174	3456	3750
130	1667	1869	2082	2307	2544	2792	3051	3323	3605
135	1605	1800	2005	2222	2450	2688	2938	3200	3472
140	1548	1735	1933	2142	2362	2592	2833	3085	3348
145	1494	1675	1867	2068	2281	2503	2736	2979	3232
150	1445	1620	1805	2000	2205	2420	2645	2880	3125
155	1398	1567	1746	1935	2133	2341	2559	2787	3024
160	1354	1518	1692	1875	2067	2268	2479	2700	2929

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	5	5¼	5½	5¾	6	6¼	6½	6¾	7
lbs.									
5	...	...	...	...	...	...	...	...	...
10	33750	37209	40837	44634	48600	...	...	...	...
15	22500	24806	27225	29756	32400	35156	38025	41006	44100
20	16875	18604	20418	22317	24300	26367	28518	30754	33075
25	13500	14883	16335	17853	19440	21093	22815	24603	26460
30	11250	12403	13612	14878	16200	17578	19012	20503	22050
35	9642	10631	11667	12752	13885	15066	16296	17574	18900
40	8437	9302	10209	11158	12150	13183	14259	15377	16537
45	7500	8268	9075	9918	10800	11718	12675	13668	14700
50	6750	7441	8167	8926	9720	10546	11407	12301	13230
55	6136	6765	7425	8115	8836	9588	10370	11183	12027
60	5625	6201	6806	7439	8100	8789	9506	10251	11025
65	5192	5724	6282	6866	7476	8112	8775	9462	10176
70	4821	5315	5833	6376	6942	7533	8148	8787	9450
75	4500	4961	5445	5951	6480	7031	7605	8201	8820
80	4218	4651	5104	5579	6075	6591	7129	7688	8268
85	3970	4377	4804	5251	5717	6204	6710	7236	7782
90	3750	4134	4537	4959	5400	5859	6337	6834	7350
95	3552	3916	4298	4698	5115	5550	6003	6474	6963
100	3375	3720	4083	4463	4860	5273	5703	6150	6615
105	3214	3543	3889	4250	4628	5022	5432	5858	6300
110	3068	3382	3712	4057	4418	4794	5185	5591	6013
115	2934	3235	3551	3881	4226	4585	4959	5348	5752
120	2812	3100	3403	3719	4050	4394	4753	5125	5512
125	2700	2976	3267	3570	3888	4218	4563	4920	5292
130	2596	2862	3141	3433	3738	4056	4387	4731	5088
135	2500	2756	3025	3306	3600	3906	4225	4556	4900
140	2410	2657	2916	3188	3471	3766	4074	4393	4725
145	2327	2566	2816	3078	3351	3636	3933	4242	4562
150	2250	2480	2722	2975	3240	3515	3802	4100	4410
155	2177	2400	2634	2879	3135	3402	3679	3968	4267
160	2109	2325	2552	2789	3037	3295	3564	3844	4134

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2-P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	5¾	6	6¼	6½	6¾	7	7¼	7½	7¾
lbs.									
5	...	...	...	...	...	...	...	...	...
10	49593	...	..	...	..	...	...	...	...
15	33062	36000	39062	42250	45562	49000	...	...	...
20	24796	27000	29296	31687	34171	36750	39421	42187	45046
25	19837	21600	23437	25350	27337	29400	31537	33750	36037
30	16531	18000	19531	21125	22781	24500	26281	28125	30031
35	14169	15428	16741	18107	19526	21000	22526	24107	25741
40	12398	13500	14648	15843	17085	18375	19710	21093	22523
45	11020	12000	13020	14083	15187	16333	17520	18750	20020
50	9918	10800	11718	12675	13668	14700	15768	16875	18018
55	9017	9818	10653	11522	12426	13363	14335	15340	16380
60	8265	9000	9765	10562	11390	12250	13140	14062	15015
65	7629	8307	9014	9750	10514	11307	12129	12980	13860
70	7084	7714	8370	9053	9763	10500	11263	12053	12870
75	6612	7200	7812	8450	9112	9800	10512	11250	12012
80	6199	6750	7324	7921	8542	9187	9855	10546	11261
85	5834	6352	6893	7455	8040	8647	9275	9926	10599
90	5510	6000	6510	7041	7593	8166	8760	9375	10010
95	5220	5684	6167	6671	7194	7736	8299	8881	9483
100	4959	5400	5859	6337	6834	7350	7884	8437	9009
105	4723	5142	5580	6035	6508	7000	7508	8035	8580
110	4508	4909	5326	5761	6213	6681	7167	7670	8190
115	4312	4695	5095	5510	5942	6391	6855	7336	7834
120	4132	4500	4882	5281	5695	6125	6570	7031	7507
125	3967	4320	4687	5070	5467	5880	6307	6750	7207
130	3814	4153	4507	4875	5257	5653	6064	6490	6930
135	3673	4000	4340	4694	5062	5444	5840	6250	6673
140	3542	3857	4185	4526	4881	5250	5631	6026	6435
145	3420	3724	4040	4370	4713	5068	5437	5818	6213
150	3306	3600	3906	4225	4556	4900	5256	5625	6006
155	3199	3483	3780	4088	4409	4741	5086	5443	5812
160	3099	3375	3662	3960	4271	4593	4927	5273	5630

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	6½	6¾	7	7¼	7½	7¾	8	8¼	8½
lbs.									
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	46475	...	...	...	...	...	...	...	...
20	34856	37589	40425	43364	46406	49551	...	...	...
25	27885	30071	32340	34691	37125	39641	42240	44921	47685
30	23237	25059	26950	28909	30937	33034	35200	37434	39737
35	19917	21479	23100	24779	26517	28315	30171	32086	34060
40	17428	18794	20212	21682	23203	24775	26400	28075	29803
45	15491	16706	17966	19272	20625	22022	23466	24956	26491
50	13942	15035	16170	17345	18562	19820	21120	22460	23842
55	12675	13668	14700	15768	16875	18018	19200	20418	21675
60	11618	12529	13475	14454	15468	16517	17600	18717	19868
65	10725	11565	12438	13342	14278	15246	16246	17277	18340
70	9958	10739	11550	12389	13258	14157	15085	16043	17030
75	9295	10023	10780	11563	12375	13213	14080	14973	15895
80	8714	9397	10106	10841	11601	12387	13200	14037	14901
85	8201	8844	9511	10203	10919	11659	12423	13212	14025
90	7745	8353	8983	9636	10312	11011	11733	12478	13245
95	7338	7913	8510	9129	9769	10431	11115	11821	12548
100	6971	7517	8085	8672	9281	9910	10560	11230	11921
105	6639	7159	7700	8259	8839	9438	10057	10695	11353
110	6337	6834	7350	7884	8437	9009	9600	10209	10837
115	6061	6537	7030	7541	8070	8617	9182	9765	10366
120	5809	6264	6737	7227	7734	8258	8800	9358	9934
125	5577	6014	6468	6938	7425	7928	8448	8984	9537
130	5362	5782	6219	6671	7139	7623	8123	8638	9170
135	5163	5568	5988	6424	6875	7340	7822	8318	8830
140	4979	5369	5775	6194	6629	7078	7542	8021	8515
145	4807	5184	5575	5981	6400	6834	7282	7745	8221
150	4647	5011	5390	5781	6187	6606	7040	7486	7947
155	4497	4850	5216	5595	5987	6393	6812	7245	7691
160	4357	4698	5053	5420	5800	6193	6600	7018	7450

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	7¼	7½	7¾	8	8¼	8½	8¾	9	9¼
lbs.									
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	47306	...	...	...	...	...	...	...	...
25	37845	40500	43245	46080	49005	...	...	...	...
30	31537	33750	36037	38400	40837	43350	45937	48600	...
35	27032	28928	30889	32914	35003	37157	39375	41657	44003
40	23653	25312	27028	28800	30628	32512	34453	36450	38503
45	21025	22500	24025	25600	27225	28900	30625	32400	34225
50	18922	20250	21622	23040	24502	26010	27562	29160	30802
55	17202	18409	19656	20945	22275	23645	25056	26509	28002
60	15768	16875	18018	19200	20418	21675	22968	24300	25668
65	14555	15576	16632	17723	18848	20007	21201	22430	23694
70	13516	14464	15444	16457	17501	18578	19687	20828	22001
75	12615	13500	14415	15360	16335	17340	18375	19440	20535
80	11826	12656	13514	14400	15314	16256	17226	18225	19251
85	11130	11911	12719	13552	14413	15300	16213	17152	18119
90	10512	11250	12012	12800	13612	14450	15312	16200	17112
95	9959	10657	11380	12126	12896	13689	14506	15347	16211
100	9461	10125	10811	11520	12251	13005	13781	14580	15401
105	9010	9642	10296	10971	11667	12385	13125	13885	14667
110	8601	9204	9828	10472	11137	11822	12528	13254	14001
115	8227	8804	9401	10017	10653	11308	11983	12678	13392
120	7884	8437	9009	9600	10209	10837	11484	12150	12834
125	7569	8100	8649	9216	9801	10404	11025	11664	12321
130	7277	7788	8316	8861	9424	10003	10600	11215	11847
135	7008	7500	8008	8533	9075	9633	10208	10800	11408
140	6758	7232	7722	8228	8750	9289	9843	10414	11000
145	6525	6982	7456	7944	8449	8968	9504	10055	10621
150	6307	6750	7207	7680	8167	8670	9187	9720	10267
155	6104	6532	6975	7432	7904	8390	8891	9406	9936
160	5913	6328	6757	7200	7657	8128	8613	9112	9625

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	8	8¼	8½	8¾	9	9¼	9½	9¾	10
lbs.									
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	49920	...	...	...	...	...	...	...	...
30	41600	44240	46962	49765	...	...	...	...	...
35	35657	37920	40253	42656	45128	47670	...	...	...
40	31200	33180	35221	37324	39487	41711	43996	46342	48750
45	27733	29493	31308	33177	35100	37077	39108	41193	43333
50	24960	26544	28177	29859	31590	33369	35197	37074	39000
55	22690	24131	25615	27144	28718	30335	31997	33703	35454
60	20800	22120	23481	24882	26325	27807	29331	30895	32500
65	19200	20418	21675	22968	24300	25668	27075	28518	30000
70	17828	18960	20126	21328	22564	23835	25141	26481	27857
75	16640	17696	18785	19906	21060	22246	23465	24716	26000
80	15600	16590	17610	18662	19743	20855	21998	23171	24375
85	14682	15614	16575	17564	18582	19629	20704	21808	22941
90	13866	14746	15654	16588	17550	18538	19554	20596	21666
95	13136	13970	14830	15715	16626	17562	18525	19512	20526
100	12480	13272	14088	14929	15795	16684	17598	18537	19500
105	11885	12640	13417	14218	15042	15890	16760	17654	18571
110	11345	12065	12807	13572	14359	15167	15998	16851	17727
115	10852	11541	12251	12982	13734	14508	15303	16119	16956
120	10400	11060	11740	12441	13162	13903	14665	15447	16250
125	9984	10617	11271	11943	12636	13347	14079	14829	15600
130	9600	10209	10837	11484	12150	12834	13537	14259	15000
135	9244	9831	10436	11059	11700	12359	13036	13731	14444
140	8914	9480	10063	10664	11282	11917	12570	13240	13928
145	8606	9153	9716	10296	10893	11506	12137	12784	13448
150	8320	8848	9392	9953	10530	11123	11732	12358	13000
155	8051	8562	9089	9632	10190	10764	11354	11959	12580
160	7800	8295	8805	9331	9871	10427	10999	11585	12187

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	8¾	9	9¼	9½	9¾	10	10¼	10½	10¾
lbs.									
5	...	...	...	...	...	...	...	...	...
10	...	...	...	..	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	..	...	...	..	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...
35	45937	48600	...	...	...	...	...	...	...
40	40195	42525	44920	47381	49907	...	...	...	...
45	35729	37800	39929	42116	44362	46666	49029	...	...
50	32156	34020	35936	37905	39926	42000	44126	46305	48536
55	29232	30927	32669	34459	36296	38181	40114	42095	44123
60	26796	28350	29946	31587	33271	35000	36771	38587	40446
65	24735	26169	27643	29157	30712	32307	33943	35619	37335
70	22968	24300	25668	27075	28518	30000	31518	33075	34668
75	21437	22680	23957	25270	26617	28000	29417	30870	32357
80	20097	21262	22460	23690	24953	26250	27578	28940	30335
85	18915	20011	21138	22297	23486	24705	25956	27238	28550
90	17864	18900	19964	21058	22181	23333	24514	25725	26964
95	16924	17905	18913	19950	21013	22105	23224	24371	25545
100	16078	17010	17968	18952	19963	21000	22063	23152	24268
105	15312	16200	17112	18050	19012	20000	21012	22050	23112
110	14616	15463	16334	17229	18148	19090	20057	21047	22061
115	13980	14791	15624	16480	17359	18260	19185	20132	21102
120	13398	14175	14973	15793	16635	17500	18385	19293	20223
125	12862	13608	14374	15162	15970	16800	17650	18522	19414
130	12367	13084	13821	14578	15356	16153	16971	17809	18667
135	11909	12600	13309	14038	14787	15555	16343	17150	17976
140	11484	12150	12834	13537	14259	15000	15759	16537	17334
145	11088	11731	12391	13070	13767	14482	15215	15967	16736
150	10718	11340	11978	12635	13308	14000	14708	15435	16178
155	10372	10974	11592	12227	12879	13548	14234	14937	15656
160	10048	10631	11230	11845	12476	13125	13789	14470	15167

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2-P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches.

CYLINDRICAL BOILER SHELLS.
Iron Plates from $\frac{1}{4}$ Inch to $1\frac{1}{4}$ Inch Thick.

Numerals and *Nominal* Factors from 4·5 to 6·9.*

By the use of the Tables Nos. 52 and 53 immediately following, and No. 351, the working pressure can be determined for any given thickness of plate and given diameter, when the calculated percentage strength of the longitudinal joint is known, and *nominal* factor fixed; the diameter can be found for a given thickness of plate, when the calculated percentage of the longitudinal joint is known and factor determined; the calculated percentage of the longitudinal joint can be obtained for a given thickness of plate, a given diameter and a given working pressure and *nominal* factor; and the thickness of the plate can be found when it is known what the diameter, working pressure, *nominal* factor, and the calculated percentage of longitudinal joint are to be. The *nominal* factor at which the boiler is, or will be, worked can also be ascertained, if between 5 and 6·9, when the thickness of the plate, the working pressure, diameter, and calculated percentage of the longitudinal joints, are known.

The Tables are computed on the assumption that the plates have a tensile strength of about 47,000 lbs. per square inch, which is usually taken as the strength in calculating the working pressure for Cylindrical Shells, Cylindrical Steam Receivers, or Domes of Boilers.

N = Numeral for the thickness and nominal factor of safety.
% = Calculated percentage of joint.
D = Diameter of boiler, inside, in inches.
B = Working pressure, in lbs., per square inch.
F = Nominal factor of safety.

$$\frac{N \times \%}{D} = B$$

$$\frac{N \times \%}{B} = D$$

$$\frac{D \times B}{N} = \%$$

$$\frac{D \times B}{\%} = N.$$

(1) If the working pressure has to be found when the plates are $1\frac{1}{4}$ inch, and the *nominal* factor 5, the calculated percentage of the joints 85·23, and the diameter 144 inches :—

Then, opposite the thickness of the plates, $1\frac{1}{4}$ inch, and under F 5, the *nominal* factor, the numeral is 235; and if it be multiplied by 85·23 (the calculated percentage of the joints), and the

* For factors below 5 see Table No. 351.

product divided by 144 (the diameter), the quotient equals the working pressure, or

$$\frac{235 \times 85 \cdot 23}{144} = 139 \cdot 09 = \text{B},$$

which is the working pressure required to be found, or, say, 140 lbs. per square inch.

(2) If the thickness of the plates is required to be determined, when the diameter is 144 inches, the pressure 140 lbs., the *nominal* factor 5, and the calculated percentage of joints 85·23 :—

Then, if 144 (the diameter) be multiplied by 140 (the pressure), and the product divided by 85·23 (the calculated percentage of joints), the quotient equals the numeral applicable to the case, which should be looked for under F 5, the *nominal* factor, and opposite the numeral the thickness required may be found, or

$$\frac{144 \times 140}{85 \cdot 23} = 236 \cdot 5 = \text{N}.$$

But the nearest numeral under F 5 is 235, and as it varies so little from 236·5 $\left(\text{that found by the formula } \frac{\text{D} \times \text{B}}{\%}\right)$, the thickness opposite N 235 is the thickness which practically meets the requirements of the case, viz., 1¼ inch.

(3) If the diameter has to be settled for a working pressure of 140 lbs. at a *nominal* factor 5, the thickness of plates 1¼ inch, and the calculated percentage of joint 85·23 :—

Then, under F 5, the factor, and opposite 1¼, the thickness of the plates, the numeral is 235 ; and if it be multiplied by 85·23, (the calculated percentage of joint), and the product divided by 140 (the pressure), the quotient equals what the diameter should be, or

$$\frac{235 \times 85 \cdot 23}{140} = 143 \cdot 06 = \text{D},$$

or, the diameter to meet the requirements of the case may be, say, 144 inches.

(4) If the calculated percentage of joints has to be determined, when the plates are 1¼ inch thick, the *nominal* factor 5, the working pressure 140 lbs., and the diameter 144 inches :—

Then, if 140, the pressure, be multiplied by 144, the diameter, and the product divided by the numeral 235 found opposite 1¼ inch, the thickness, and under F 5, the *nominal* factor, the quotient equals the calculated percentage of joint, or

$$\frac{140 \times 144}{235} = 85 \cdot 78 = \%,$$

but a suitable calculated percentage of joint for such a thickness of plate, when the riveting is as illustrated in Tables Nos. 63 and 64, is 85·23, which may be adopted without materially affecting the result.

The calculated percentages of joints made of iron plates and iron rivets, of various descriptions of riveting and of different thickness of plates, are given in Tables Nos. 54 to 64.

The *nominal* factor can be found by the tables when N, the numeral, is obtained $\left(\text{by the formula } \frac{D \times B}{\%}\right)$ for the given thickness, as above the numerals in any one column, the factor under F is the *nominal* factor in the particular case If the exact numeral is not found opposite any given thickness, within the range of the Tables, but a numeral is between any two numerals, opposite the given thickness, then the *nominal* factor is between the factors at the top of the two columns in which the numerals are found—one slightly under and the other rather higher. Therefore the factor can always be determined within about one per cent., although the exact numeral may not be found in the Tables.

Thus, if the thickness be 1¼ inch and

$$\frac{D \times B}{\%} = 235,$$

235 is found opposite 1¼, and at the top of column in which 235 is found, the *nominal* factor is 5 ; but if by the formula the numeral arrived at had been, say, 232·2 (which is a number between the two numerals given in the Table opposite 1¼), then the *nominal* factor would be rather less than 5·1, but slightly over 5.

Iron Plates from $\frac{1}{4}$ inch to $1\frac{1}{4}$ inch Thick.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5·0	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
ins.	N	N	N	N	N	N	N	N	N	N
1/4	47·0	46·07	45·19	44·33	43·51	42·72	41·96	41·22	40·51	39·83
9/32	52·87	51·83	50·84	49·88	48·95	48·06	47·20	46·38	45·58	44·80
5/16	58·75	57·59	56·49	55·42	54·39	53·40	52·45	51·53	50·64	49·78
11/32	64·62	63·35	62·13	60·96	59·83	58·75	57·70	56·68	55·71	54·76
3/8	70·50	69·11	67·78	66·50	65·27	64·09	62·94	61·84	60·77	59·74
13/32	76·37	74·87	73·43	72·05	70·71	69·43	68·19	66·99	65·84	64·72
7/16	82·25	80·63	79·08	77·59	76·15	74·77	73·43	72·14	70·90	69·70
15/32	88·12	86·39	84·73	83·13	81·59	80·11	78·68	77·30	75·96	74·68
1/2	94·0	92·15	90·38	88·67	87·03	85·45	83·92	82·45	81·03	79·66
17/32	99·87	97·91	96·03	94·22	92·47	90·79	89·17	87·60	86·09	84·63
9/16	105·75	103·67	101·68	99·76	97·91	96·13	94·41	92·76	91·16	89·61
19/32	111·62	109·43	107·33	105·30	103·35	101·47	99·66	97·91	96·22	94·59
5/8	117·50	115·19	112·98	110·84	108·79	106·81	104·91	103·07	101·29	99·57
21/32	123·37	120·95	118·62	116·39	114·23	112·15	110·15	108·22	106·35	104·55
11/16	129·25	126·71	124·27	121·93	119·67	117·50	115·40	113·37	111·42	109·53
23/32	135·12	132·47	129·92	127·47	125·11	122·84	120·64	118·53	116·48	114·51
3/4	141·0	138·23	135·57	133·01	130·55	128·18	125·89	123·68	121·55	119·49
25/32	146·87	143·99	141·22	138·56	135·99	133·52	131·13	128·83	126·61	124·47
13/16	152·75	149·75	146·87	144·10	141·43	138·86	136·38	133·99	131·68	129·44
27/32	158·62	155·51	152·52	149·64	146·87	144·20	141·62	139·14	136·74	134·42
7/8	164·50	161·27	158·17	155·18	152·31	149·54	146·87	144·29	141·81	139·40
29/32	170·37	167·03	163·82	160·73	157·75	154·88	152·12	149·45	146·87	144·38
15/16	176·25	172·79	169·47	166·27	163·19	160·22	157·36	154·60	151·93	149·36
31/32	182·12	178·55	175·12	171·81	168·63	165·56	162·61	159·75	157·0	154·34
1	188·0	184·31	180·76	177·35	174·07	170·90	167·85	164·91	162·06	159·32
1 1/32	193·87	190·07	186·41	182·90	179·51	176·25	173·10	170·06	167·13	164·30
1 1/16	199·75	195·83	192·06	188·44	184·95	181·59	178·34	175·21	172·19	169·27
1 3/32	205·62	201·59	197·71	193·98	190·39	186·93	183·59	180·37	177·26	174·25
1 1/8	211·50	207·35	203·36	199·52	195·83	192·27	188·83	185·52	182·32	179·23
1 5/32	217·37	213·11	209·01	205·07	201·27	197·61	194·08	190·67	187·39	184·21
1 3/16	223·25	218·87	214·66	210·61	206·71	202·95	199·33	195·83	192·45	189·19
1 7/32	229·12	224·63	220·31	216·15	212·15	208·29	204·57	200·98	197·52	194·17
1 1/4	235·0	230·39	225·96	221·69	217·59	213·63	209·82	206·14	202·58	199·15

$$\frac{N \times \%}{D} = B. \qquad \frac{N \times \%}{B} = D. \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N.$$

N = Numeral. % = Calculated percentage strength of joint.
D = Inside diameter in inches.
B = Working pressure per square inch in pounds.

Iron Plates from $\frac{1}{4}$ inch to $1\frac{1}{4}$ inch Thick.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6·0	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ins.	N	N	N	N	N	N	N	N	N	N
$\frac{1}{4}$	39·16	38·52	37·90	37·30	36·71	36·15	35·60	35·07	34·55	34·05
$\frac{9}{32}$	44·06	43·34	42·64	41·96	41·30	40·67	40·05	39·45	38·87	38·31
$\frac{5}{16}$	48·95	48·15	47·37	46·62	45·89	45·19	44·50	43·84	43·19	42·57
$\frac{11}{32}$	53·85	52·97	52·11	51·28	50·48	49·71	48·95	48·22	47·51	46·82
$\frac{3}{8}$	58·75	57·78	56·85	55·95	55·07	54·23	53·40	52·61	51·83	51·08
$\frac{13}{32}$	63·64	62·60	61·59	60·61	59·66	58·75	57·85	56·99	56·15	55·34
$\frac{7}{16}$	68·54	67·41	66·33	65·27	64·25	63·26	62·31	61·38	60·47	59·60
$\frac{15}{32}$	73·43	72·23	71·06	69·94	68·84	67·78	66·76	65·76	64·79	63·85
$\frac{1}{2}$	78·33	77·04	75·80	74·60	73·43	72·30	71·21	70·14	69·11	68·11
$\frac{17}{32}$	83·22	81·86	80·54	79·26	78·02	76·82	75·66	74·53	73·43	72·37
$\frac{9}{16}$	88·12	86·68	85·28	83·92	82·61	81·34	80·11	78·91	77·75	76·63
$\frac{19}{32}$	93·02	91·49	90·02	88·59	87·20	85·86	84·56	83·30	82·07	80·88
$\frac{5}{8}$	97·91	96 31	94·75	93·25	91·79	90·38	89·01	87·68	86·39	85·14
$\frac{21}{32}$	102·81	101·12	99·49	97·91	96·38	94·90	93·46	92·07	90·71	89·40
$\frac{11}{16}$	107·70	105·94	104·23	102·57	100·97	99·42	97·91	96·45	95·03	93·65
$\frac{23}{32}$	112·60	110·75	108·97	107·24	105·56	103·94	102·36	100·83	99·35	97·91
$\frac{3}{4}$	117·50	115·57	113·70	111·90	110·15	108·46	106·81	105·22	103·67	102·17
$\frac{25}{32}$	122·39	120·38	118·44	116·56	114·74	112·98	111·26	109·60	107·99	106·43
$\frac{13}{16}$	127·29	125·20	123·18	121·23	119·33	117·50	115·71	113·99	112·31	110·68
$\frac{27}{32}$	132·18	130·02	127·92	125·89	123·92	122·01	120·17	118·37	116·63	114·94
$\frac{7}{8}$	137·08	134·83	132·66	130 55	128·51	126·53	124·62	122·76	120·95	119 20
$\frac{29}{32}$	141·97	139·65	137·39	135·21	133·10	131·05	129·07	127·14	125·27	123·46
$\frac{15}{16}$	146·87	144·46	142·13	139·88	137·69	135·57	133·52	131·52	129·59	127·71
$\frac{31}{32}$	151·77	149·28	146·87	144·54	142·28	140·09	137·97	135·91	133·91	131·97
1	156·66	154·09	151·61	149·20	146·87	144·61	142·42	140·29	138·23	136·23
$1\frac{1}{32}$	161·56	158·91	156·35	153·86	151·46	149·13	146·87	144·68	142·55	140·48
$1\frac{1}{16}$	166·45	163·72	161·08	158·53	156·05	153·65	151·32	149·06	146·87	144·74
$1\frac{3}{32}$	171·35	168·54	165·82	163·19	160·64	158·17	155·77	153·45	151·19	149·00
$1\frac{1}{8}$	176·25	173·36	170·56	167·85	165·23	162·69	160·22	157·83	155·51	153·26
$1\frac{5}{32}$	181·14	178·17	175·30	172·51	169·82	167·21	164·67	162·22	159·83	157·51
$1\frac{3}{16}$	186·04	182·99	180·04	177·18	174·41	171·73	169·12	166·60	164·15	161·77
$1\frac{7}{32}$	190·93	187·80	184·77	181·84	179·0	176·25	173·57	170·98	168·47	166·03
$1\frac{1}{4}$	195·83	192·62	189·51	186·50	183·59	180·76	178·03	175·37	172·79	170·28

$$\frac{N \times \%}{D} = B. \qquad \frac{N \times \%}{B} = D. \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N.$$

N = Numeral. % = Calculated percentage strength of joint.
D = Inside diameter in inches.
B = Working pressure per square inch in pounds.

IRON PLATES AND IRON RIVETS.

Riveted Joints.

In the Tables Nos. 54 to 64, which immediately follow these remarks, the particulars as to the proportions of riveted joints, made of iron plates with iron rivets, are given. By the use of these tables the working pressure may be found for any given diameter of boiler and *nominal* factor of safety, or the diameter determined for a given working pressure and *nominal* factor, or the *nominal* factor ascertained for a given pressure and diameter.

The tables have been computed on the assumption that the tensile strength of iron boiler plates is about 47000 lbs. per square inch, which is the usual recognised number used in making such calculations; the shearing strength of the rivets, per square inch, is assumed as equal to the tensile strength of the plates, which is generally done when iron plates and iron rivets are used in boilers.

The calculated percentage of joint, as given opposite the thickness of plate, in each case, is applicable when the diameter and pitch of rivets are in accordance with the tables, and centre of rivets to edge of plates and distance between rows of rivets, not less than given opposite the particular thickness of plate.

The pitches of the rivets, in Column *p*, are given in the tables in decimal parts of an inch, but the nearest $1/32$ part of an inch may be adopted without materially affecting the result.

The distance between the rows of rivets, in Column V, and centre of rivets to edge of plates, in Column E, should not be less than that given in the table for the description of joint shown by the sketches at the top of the table, and opposite the particular thickness of plate.

N = Numeral opposite the thickness of the plate, and applicable to the description of riveting, as shown in the sketches at the top of the table from which the numeral is selected, and the riveting proportioned as given opposite the thickness in question. *The table used must always be that for the particular description of joint which is being dealt with.*

D = Diameter of boiler, inside, in inches.

B = Working pressure, in lbs., per square inch.

F = Nominal factor of safety, the value of which should, in a great measure, be determined according to the method of construction (see pages 17, 18, 19, and 20).

$$D \times B \times F = N.$$

$$\frac{N}{B \times F} = D.$$

$$\frac{N}{D \times F} = B.$$

$$\frac{N}{D \times B} = F.$$

(1) If the working pressure be required to be found, when the longitudinal seams are of the ordinary double riveted description, either zig-zag or chain riveted, and have double butt straps, the plates being of iron ⅝ inch thick, and the rivets also of iron, the inside diameter of the boiler 90 inches, and the *nominal* factor of safety 5:—

In the table of iron plates and iron rivets, double riveted double butt straps, ordinary zig-zag or chain riveting, as shown in the sketches at the top of Table No. 60, then, on the left, opposite ⅝, the thickness of the plate, the numeral N is found to be 45901, and if that be divided by the product of 90, the diameter, and 5, the *nominal* factor, the *quotient* is the working pressure. The calculated percentage strength of the joint is 78·13, as found on the right, opposite the thickness ⅝ inch, which is the value, if the riveting be of the description stated, and the pitch and rivets, &c., are as given opposite the thickness of plate, or—

$$\frac{45901}{90 \times 5} = 102 = B,$$

the working pressure, in lbs., per square inch.

(2) If the diameter of a boiler is required to be determined when the riveting is the *same* as above, the plates being also ⅝ inch thick, the *nominal* factor 5, and the pressure 100 lbs.:—

Opposite ⅝ inch, thickness of plate, the numeral N is 45901, which divided by 100 × 5 (the pressure and factor respectively) equals the working pressure, or

$$\frac{45901}{100 \times 5} = 91{\cdot}8 = D,$$

the inside diameter, in inches, which the boiler may have, or, say, 92 inches.

(3) If it is wished to determine what factor of safety a boiler is working at when the riveting is the same as above, the plates ⅝ inch thick (opposite the calculated percentage 78·13 is found on the right) the numeral N (opposite ⅝, on the left), 45901, the diameter being 90 inches, and the pressure 100 lbs.:—

The factor of safety is found by dividing the numeral 45901 by the product of 90, the diameter, and 100, the pressure, or

$$\frac{45901}{100 \times 90} = 5{\cdot}1 = F,$$

the *nominal* factor at which such a boiler works under the circumstances stated.

(4) If it is wished to determine what thickness the shell of an iron boiler should be, if the working pressure is required to be 100 lbs., the diameter 90 inches, and the *nominal* factor 5·1, the joints being double riveted with double butt straps fitted :—

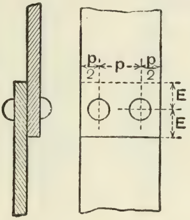
The product of 100, the pressure, 90 the diameter, and 5·1, the *nominal* factor, equals 45900; the nearest numeral N, in the table for the description of joints specified, is 45901, and opposite it the thickness of plate is ⅝ inch, which is the thickness the shell should be. The particulars of the riveting and calculated percentage of joint are found on the right, opposite the thickness ⅝ inch.

The foregoing remarks will facilitate the use of any of the Tables Nos. 54 to 64 for iron plates and iron rivets; but, as stated before, the table for the particular description of joint must be used, as each table is only applicable to the description of joint shown in the sketch at the top of the table.

The pressure, &c. arrived at may sometimes be fractionally over or under a whole number, but such slight differences can be adjusted according to the circumstances of the case, even a pound or two more or less will not *generally* be a serious matter; for instance, if the pressure arrived at is, say, 102 lbs., no great loss would result from working at 100 lbs., and no great harm at 105 lbs., if the circumstances of the case should make it desirable to do so.

IRON PLATES AND IRON RIVETS.

Single Riveted Lap Joints.



D×B×F. N	Thickness of Plates. T	Diameter of Rivets. d	Pitch of Rivets. p	Centre of Rivets to Edge of Plates. E	Percentage of Joint.
13865	1/4	5/8	1·524	·937	59·00
15598	9/32	21/32	1·600	·984	59·00
17331	5/16	11/16	1·676	1·031	59·00
19064	11/32	23/32	1·753	1·078	59·00
20797	3/8	3/4	1·829	1·125	59·00
22530	13/32	25/32	1·905	1·171	59·00
24263	7/16	13/16	1·981	1·218	59·00
25798	15/32	27/32	2·036	1·265	58·55
27198	1/2	7/8	2·077	1·312	57·87
28589	17/32	29/32	2·120	1·359	57·25
29964	9/16	15/16	2·164	1·406	56·67
31344	19/32	31/32	2·210	1·453	56·16
32706	5/8	1	2·256	1·500	55·67
34076	21/32	1 1/32	2·304	1·546	55·24
35427	11/16	1 1/16	2·352	1·593	54·82
36767	23/32	1 3/32	2·400	1·640	54·42
38126	3/4	1 1/8	2·450	1·687	54·08
39472	25/32	1 5/32	2·500	1·734	53·75
40807	13/16	1 3/16	2·550	1·781	53·43
42146	27/32	1 7/32	2·601	1·828	53·14
43477	7/8	1 1/4	2·652	1·875	52·86
44800	29/32	1 9/32	2·703	1·921	52·59
46133	15/16	1 5/16	2·755	1·968	52·35

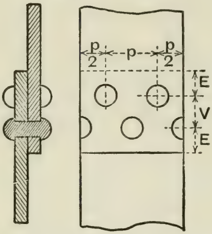
N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

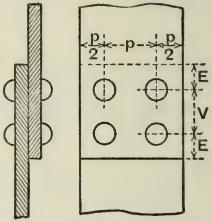
IRON PLATES AND IRON RIVETS.

Double Riveted Lap Joints.

Zig Zag Riveting.



Chain Riveting.



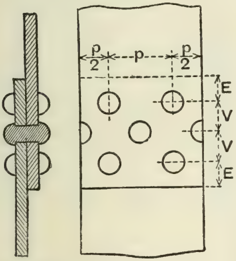
D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Percentage of Joint.
N	T	d	p	E	V	V	
21296	5/16	5/8	2·272	·937	1·145	1·750	72·50
23426	11/32	21/32	2·386	·984	1·202	1·812	72·50
25556	3/8	11/16	2·500	1·031	1·260	1·875	72·50
27685	13/32	23/32	2·613	1·078	1·317	1·937	72·50
29815	7/16	3/4	2·727	1·125	1·374	2·000	72·50
31879	15/32	25/32	2·826	1·171	1·426	2·062	72·35
33764	1/2	13/16	2·886	1·218	1·465	2·125	71·84
35640	17/32	27/32	2·948	1·265	1·504	2·187	71·37
37514	9/16	7/8	3·013	1·312	1·544	2·250	70·95
39381	19/32	29/32	3·079	1·359	1·585	2·312	70·56
41242	5/8	15/16	3·146	1·406	1·626	2·375	70·20
43094	21/32	31/32	3·215	1·453	1·667	2·437	69·86
44940	11/16	1	3·284	1·500	1·709	2·500	69·54
46793	23/32	1 1/32	3·355	1·546	1·751	2·562	69·26
48630	3/4	1 1/16	3·426	1·593	1·794	2·625	68·98
50473	25/32	1 3/32	3·498	1·640	1·836	2·687	68·73
52309	13/16	1 1/8	3·571	1·687	1·879	2·750	68·49
54146	27/32	1 5/32	3·645	1·734	1·923	2·812	68·27
55979	7/8	1 3/16	3·718	1·781	1·966	2·875	68·06
57808	29/32	1 7/32	3·793	1·828	2·009	2·937	67·86
59634	15/16	1 1/4	3·867	1·875	2·053	3·000	67·67
61458	31/32	1 9/32	3·942	1·921	2·096	3·062	67·49
63290	1	1 5/16	4·018	1·968	2·140	3·125	67·33

N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

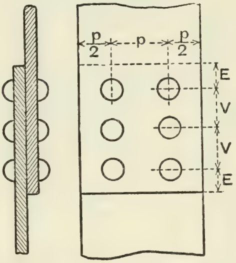
$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

Treble Riveted Lap Joints.

Zig Zag Riveting.



Chain Riveting.



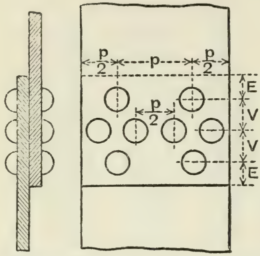
D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Chain Riveting.	Percentage of Joint.
N	T	d	p	E	V	V	
27671	3/8	5/8	2·906	·937	1·365	1·750	78·50
29977	13/32	21/32	3·052	·984	1·433	1·812	78·50
32283	7/16	11/16	3·197	1·031	1·501	1·875	78·50
34505	15/32	23/32	3·315	1·078	1·560	1·937	78·31
36631	1/2	3/4	3·400	1·125	1·607	2·000	77·94
38751	17/32	25/32	3·488	1·171	1·656	2·062	77·60
40861	9/16	13/16	3·577	1·218	1·705	2·125	77·28
42970	19/32	27/32	3·668	1·265	1·754	2·187	76·99
45078	5/8	7/8	3·761	1·312	1·805	2·250	76·73
47178	21/32	29/32	3·854	1·359	1·855	2·312	76·48
49276	11/16	15/16	3·949	1·406	1·905	2·375	76·25
51374	23/32	31/32	4·045	1·453	1·957	2·437	76·04
53474	3/4	1	4·141	1·500	2·008	2·500	75·85
55562	25/32	1 1/32	4·238	1·546	2·060	2·562	75·66
57655	13/16	1 1/16	4·336	1·593	2·111	2·625	75·49
59746	27/32	1 3/32	4·434	1·640	2·163	2·687	75·33
61827	7/8	1 1/8	4·533	1·687	2·215	2·750	75·17
63916	29/32	1 5/32	4·632	1·734	2·268	2·812	75·03
65996	15/16	1 3/16	4·731	1·781	2·320	2·875	74·89
68087	31/32	1 7/32	4·831	1·828	2·372	2·937	74·77
70171	1	1 1/4	4·931	1·875	2·425	3·000	74·65
72247	1 1/32	1 9/32	5·031	1·921	2·478	3·062	74·53
74326	1 1/16	1 5/16	5·132	1·968	2·530	3·125	74·42

N=Numeral. D=Diameter of boiler, inside, in inches.
B=Working pressure, in pounds, per square inch. F=*Nominal* factor of safety.

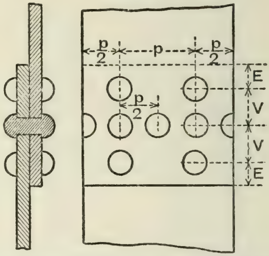
$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

Treble Riveted Lap Joints ; each alternate Rivet omitted in the outer rows.

Zig Zag Riveting.



Chain Riveting.



D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets.		Percentage of Joints.
					Zig Zag Riveting	Chain Riveting.	
N	T	d	p	E	V	V	
33627	7/16	5/8	3·430	·937	1·414	1·750	81·77
35897	15/32	21/32	3·542	·984	1·473	1·812	81·47
38164	1/2	11/16	3·657	1·031	1·532	1·875	81·20
40424	17/32	23/32	3·773	1·078	1·592	1·937	80·95
42680	9/16	3/4	3·891	1·125	1·652	2·000	80·72
44934	19/32	25/32	4·010	1·171	1·712	2·062	80·51
47188	5/8	13/16	4·130	1·218	1·772	2·125	80·32
49442	21/32	27/32	4-251	1·265	1·833	2·187	80·15
51700	11/16	7/8	4·375	1·312	1·894	2·250	80·00
54050	23/32	15/16	4·687	1·406	2·029	2·375	80·00
56400	3/4	31/32	4·843	1·453	2·097	2·437	80·00
58750	25/32	1	5·000	1·500	2·165	2·500	80·00
61100	13/16	1 1/32	5·156	1·546	2·232	2·562	80·00
63450	27/32	1 3/32	5·468	1·640	2·368	2·687	80·00
65800	7/8	1 1/8	5·625	1·687	2·435	2·750	80·00
68150	29/32	1 5/32	5·781	1·734	2·503	2·812	80·00
70500	15/16	1 7/32	6·093	1·828	2·638	2·937	80·00
72850	31/32	1 1/4	6·250	1·875	2·706	3·000	80·00
75200	1	1 9/32	6·406	1·921	2·773	3·062	80·00
77550	1 1/32	1 5/16	6·562	1·968	2·841	3·125	80·00
79900	1 1/16	1 3/8	6·875	2·062	2·976	3·250	80·00
82250	1 3/32	1 13/32	7·031	2·109	3·044	3·312	80·00
84600	1 1/8	1 7/16	7·187	2·156	3·112	3·375	80·00

N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

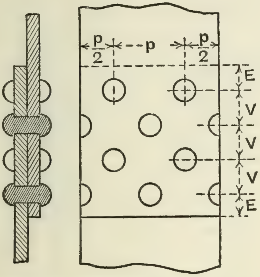
$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

IRON PLATES AND IRON RIVETS.

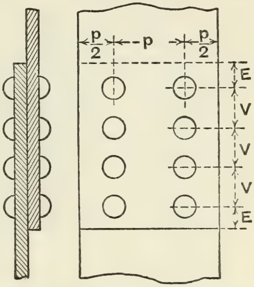
TABLE No. 58.

Quadruple Riveted Lap Joints.

Zig Zag Riveting.



Chain Riveting.



D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Percentage of Joint.
N	T	d	p	E	V	V	
33627	7/16	5/8	3·430	0·937	1·544	1·750	81·77
35897	15/32	21/32	3·542	0·984	1·601	1·812	81·47
38164	1/2	11/16	3·657	1·031	1·659	1·875	81·20
40424	17/32	23/32	3·773	1·078	1·717	1·937	80·95
42680	9/16	3/4	3·891	1·125	1·776	2·000	80·72
44934	19/32	25/32	4·010	1·171	1·835	2·062	80·51
47188	5/8	13/16	4·130	1·218	1·895	2·125	80·32
49442	21/32	27/32	4·251	1·265	1·955	2·187	80·15
51693	11/16	7/8	4·373	1·312	2·015	2·250	79·99
53941	23/32	29/32	4·496	1·359	2·076	2·312	79·84
56188	3/4	15/16	4·619	1·406	2·136	2·375	79·70
58434	25/32	31/32	4·742	1·453	2·197	2·437	79·57
60672	13/16	1	4·866	1·500	2·258	2·500	79·44
62918	27/32	1 1/32	4·990	1·546	2·319	2·562	79·33
65158	7/8	1 1/16	5·115	1·593	2·380	2·625	79·22
67400	29/32	1 3/32	5·240	1·640	2·441	2·687	79·12
69645	15/16	1 1/8	5·366	1·687	2·503	2·750	79·03
71884	31/32	1 5/32	5·491	1·734	2·564	2·812	78·94
74119	1	1 3/16	5·617	1·781	2·626	2·875	78·85
76357	1 1/32	1 7/32	5·743	1·828	2·688	2·937	78·77
78601	1 1/16	1 1/4	5·870	1·875	2·749	3·000	78·70
80841	1 3/32	1 9/32	5·996	1·921	2·811	3·062	78·63
83077	1 1/8	1 5/16	6·123	1·968	2·873	3·125	78·56

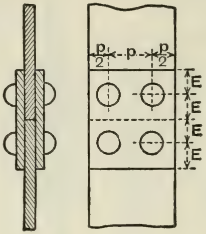
N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

IRON PLATES AND IRON RIVETS.

Single Riveted Double Butt Joints.

TABLE No. 59.



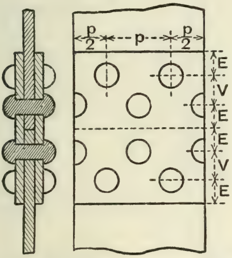
D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	T_1	
23970	3/8	5/8	1·953	0·937	·234	68·00
25967	13/32	21/32	2·050	0·984	·253	68·00
27965	7/16	11/16	2·148	1·031	·273	68·00
29878	15/32	23/32	2·233	1·078	·292	67·81
31645	1/2	3/4	2·296	1·125	·312	67·33
33403	17/32	25/32	2·360	1·171	·332	66·89
35156	9/16	13/16	2·425	1·218	·351	66·49
36903	19/32	27/32	2·491	1·265	·371	66·12
38651	5/8	7/8	2·558	1·312	·390	65·79
40392	21/32	29/32	2·626	1·359	·410	65·48
42135	11/16	15/16	2·694	1·406	·429	65·20
43868	23/32	31/32	2·763	1·453	·449	64·93
45599	3/4	1	2·832	1·500	·468	64·68
47337	25/32	1 1/32	2·902	1·546	·488	64·46
49063	13/16	1 1/16	2·972	1·593	·507	64·24
50791	27/32	1 3/32	3·042	1·640	·527	64·04
52524	7/8	1 1/8	3·113	1·687	·546	63·86
54238	29/32	1 5/32	3·183	1·734	·566	63·67
55959	15/16	1 3/16	3·254	1·781	·585	63·50
57688	31/32	1 7/32	3·326	1·828	·605	63·35
59408	1	1 1/4	3·397	1·875	·625	63·20
61128	1 1/32	1 9/32	3·469	1·921	·644	63·06
62841	1 1/16	1 5/16	3·540	1·968	·664	62·92

N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

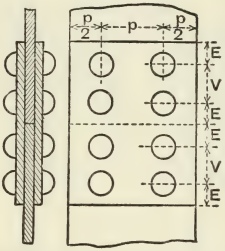
$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

Double Riveted Double Butt Joints.

Zig Zag Riveting.



Chain Riveting.

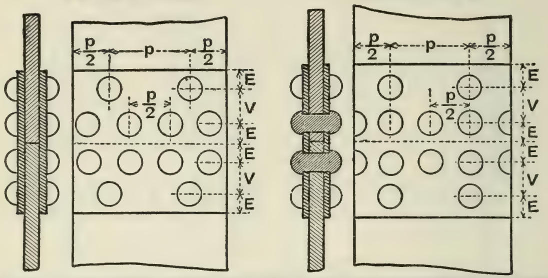


D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets.		Thickness of Butt Straps.	Percentage of Joint.
					Zig Zag Riveting.	Chain Riveting.		
N	T	d	p	E	V	V	T_1	
32776	7/16	5/8	3·079	0·937	1·424	1·750	·273	79·70
34972	15/32	21/32	3·181	0·984	1·477	1·812	·292	79·37
37162	1/2	11/16	3·286	1·031	1·532	1·875	·312	79·07
39350	17/32	23/32	3·391	1·078	1·586	1·937	·332	78·80
41538	9/16	3/4	3·498	1·125	1·641	2·000	·351	78·56
43717	19/32	25/32	3·606	1·171	1·697	2·062	·371	78·33
45901	5/8	13/16	3·716	1·218	1·753	2·125	·390	78·13
48079	21/32	27/32	3·825	1·265	1·808	2·187	·410	77·94
50252	11/16	7/8	3·936	1·312	1·865	2·250	·429	77·76
52428	23/32	29/32	4·047	1·359	1·921	2·312	·449	77·60
54602	3/4	15/16	4·158	1·406	1·978	2·375	·468	77·45
56774	25/32	31/32	4·270	1·453	2·035	2·437	·488	77·31
58946	13/16	1	4·383	1·500	2·092	2·500	·507	77·18
61110	27/32	1 1/32	4·495	1·546	2·149	2·562	·527	77·05
63283	7/8	1 1/16	4·609	1·593	2·206	2·625	·546	76·94
65449	29/32	1 3/32	4·722	1·640	2·263	2·687	·566	76·83
67618	15/16	1 1/8	4·836	1·687	2·320	2·750	·585	76·73
69781	31/32	1 5/32	4·949	1·734	2·377	2·812	·605	76·63
71947	1	1 3/16	5·063	1·781	2·435	2·875	·625	76·54
74118	1 1/32	1 7/32	5·178	1·828	2·493	2·937	·644	76·46
76274	1 1/16	1 1/4	5·292	1·875	2·550	3·000	·664	76·37
78435	1 3/32	1 9/32	5·406	1·921	2·608	3·062	·683	76·29
80602	1 1/8	1 5/16	5·521	1·968	2·665	3·125	·703	76·22

N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

Double Riveted Double Butt Joints, each alternate Rivet omitted in the outer rows.



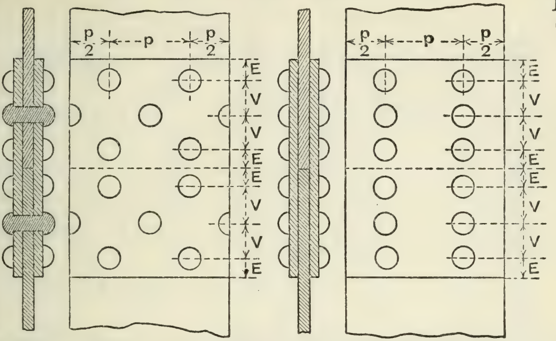
D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
39357	1/2	5/8	3·846	0·937	1·496	1·750	·387	83·74
41737	17/32	21/32	3·998	0·984	1·563	1·812	·413	83·58
44118	9/16	11/16	4·152	1·031	1·630	1·875	·438	83·44
46491	19/32	23/32	4·306	1·078	1·698	1·937	·464	83·30
48868	5/8	3/4	4·461	1·125	1·765	2·000	·489	83·18
51243	21/32	25/32	4·616	1·171	1·833	2·062	·515	83·07
53619	11/16	13/16	4·771	1·218	1·900	2·125	·540	82·97
55989	23/32	27/32	4·927	1·265	1·968	2·187	·566	82·87
58359	3/4	7/8	5·084	1·312	2·036	2·258	·591	82·78
60732	25/32	29/32	5·240	1·359	2·103	2·330	·617	82·70
63101	13/16	15/16	5·397	1·406	2·171	2·402	·642	82·62
65472	27/32	31/32	5·555	1·453	2·239	2·475	·668	82·55
67848	7/8	1	5·712	1·500	2·307	2·547	·694	82·49
70211	29/32	1 1/32	5·869	1·546	2·375	2·619	·719	82·42
72588	15/16	1 1/16	6·027	1·593	2·443	2·692	·745	82·37
74953	31/32	1 3/32	6·185	1·640	2·511	2·765	·771	82·31
77324	1	1 1/8	6·343	1·687	2·579	2·837	·796	82·26
79692	1 1/32	1 5/32	6·501	1·734	2·647	2·910	·822	82·21
82057	1 1/16	1 3/16	6·659	1·781	2·715	2·983	·848	82·16
84429	1 3/32	1 7/32	6·818	1·828	2·783	3·056	·873	82·12
86799	1 1/8	1 1/4	6·976	1·875	2·851	3·128	·899	82·08
89167	1 5/32	1 9/32	7·135	1·921	2·920	3·201	·925	82·04
91532	1 3/16	1 5/16	7·294	1·968	2·988	3·274	·950	82·00

N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

Treble Riveted Double Butt Joints.

Zig Zag Riveting.



Chain Riveting.

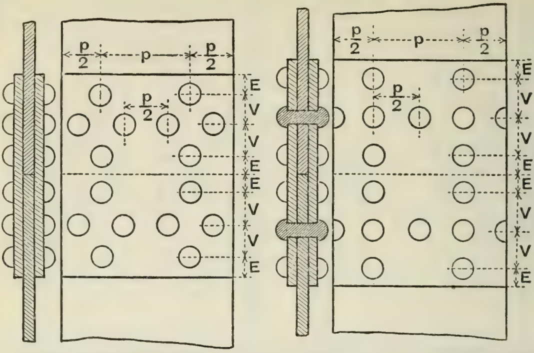
D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Thickness of Butt Strap.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
39357	1/2	5/8	3·846	0·937	1·686	1·750	·312	83·74
41737	17/32	21/32	3·998	0·984	1·756	1·812	·332	83·58
44118	9/16	11/16	4·152	1·031	1·828	1·875	·351	83·44
46491	19/32	23/32	4·306	1·078	1·899	1·937	·371	83·30
48868	5/8	3/4	4·461	1·125	1·971	2·000	·390	83·18
51243	21/32	25/32	4·616	1·171	2·042	2·062	·410	83·07
53619	11/16	13/16	4·771	1·218	2·114	2·125	·429	82·97
55989	23/32	27/32	4·927	1·265	2·186	2·187	·449	82·87
58359	3/4	7/8	5·084	1·312	2·258	2·250	·468	82·78
60732	25/32	29/32	5·240	1·359	2·330	2·312	·488	82·70
63101	13/16	15/16	5·397	1·406	2·402	2·375	·507	82·62
65472	27/32	31/32	5·555	1·453	2·475	2·437	·527	82·55
67848	7/8	1	5·712	1·500	2·547	2·500	·546	82·49
70211	29/32	1 1/32	5·869	1·546	2·619	2·562	·566	82·42
72588	15/16	1 1/16	6·027	1·593	2·692	2·625	·585	82·37
74953	31/32	1 3/32	6·185	1·640	2·765	2·687	·605	82·31
77324	1	1 1/8	6·343	1·687	2·837	2·750	·625	82·26
79692	1 1/32	1 5/32	6·501	1·734	2·910	2·812	·644	82·21
82057	1 1/16	1 3/16	6·659	1·781	2·983	2·875	·664	82·16
84429	1 3/32	1 7/32	6·818	1·828	3·056	2·937	·683	82·12
86799	1 1/8	1 1/4	6·976	1·875	3·128	3·000	·703	82·08
89167	1 5/32	1 9/32	7·135	1·921	3·201	3·062	·722	82·04
91532	1 3/16	1 5/16	7·294	1·968	3·274	3·125	·742	82·00

N=Numeral. D=Diameter of boiler, inside, in inches.
B=Working pressure, in pounds, per square inch. F=*Nominal* factor of safety.

$D\times B\times F = N \qquad \frac{N}{B\times F} = D \qquad \frac{N}{D\times F} = B \qquad \frac{N}{D\times B} = F$

TABLE No. 63.

Treble Riveted Double Butt Joints, Zig Zag Riveting.



Chain Riveting. each alternate Rivet omitted in the outer and inner rows.

D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Chain Riveting.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
45430	9/16	5/8	4·442	0·937	1·612	1·888	·351	85·92
47920	19/32	21/32	4·643	0·984	1·688	1·975	·371	85·86
50407	5/8	11/16	4·844	1·031	1·765	2·062	·390	85·80
52897	21/32	23/32	5·046	1·078	1·841	2·150	·410	85·75
55383	11/16	3/4	5·248	1·125	1·918	2·238	·429	85·70
57874	23/32	25/32	5·449	1·171	1·995	2·325	·449	85·66
60362	3/4	13/16	5·651	1·218	2·072	2·412	·468	85·62
62847	25/32	27/32	5·853	1·265	2·148	2·500	·488	85·58
65331	13/16	7/8	6·055	1·312	2·225	2·588	·507	85·54
67820	27/32	29/32	6·257	1·359	2·302	2·675	·527	85·51
70307	7/8	15/16	6·459	1·406	2·378	2·763	·546	85·48
72792	29/32	31/32	6·661	1·453	2·455	2·850	·566	85·45
75285	15/16	1	6·864	1·500	2·532	2·938	·585	85·43
77767	31/32	1 1/32	7·066	1·546	2·609	3·026	·605	85·40
80257	1	1 1/16	7·268	1·593	2·686	3·114	·625	85·38
82736	1 1/32	1 3/32	7·470	1·640	2·762	3·201	·644	85·35
85223	1 1/16	1 1/8	7·673	1·687	2·839	3·289	·664	85·33
87709	1 3/32	1 5/32	7·876	1·734	2·916	3·377	·683	85·31
90194	1 1/8	1 3/16	8·078	1·781	2·993	3·465	·703	85·29
92688	1 5/32	1 7/32	8·281	1·828	3·070	3·553	·722	85·28
95171	1 3/16	1 1/4	8·484	1·875	3·147	3·641	·742	85·26
97653	1 7/32	1 9/32	8·686	1·921	3·223	3·728	·761	85·24
100145	1 1/4	1 5/16	8·888	1·968	3·300	3·816	·781	85·23

N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

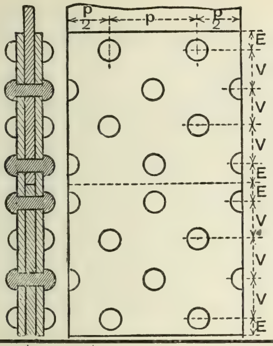
$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

IRON PLATES AND IRON RIVETS.

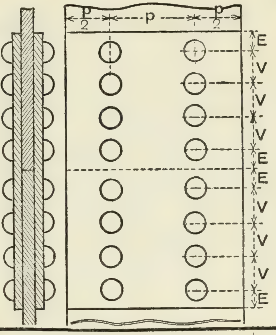
Table No. 64.

Quadruple Riveted

Zig Zag Riveting.



Chain Riveting.



Double Butt Joints.

D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
45430	9/16	5/8	4·442	0·937	1·888	1·750	·351	85·92
47920	19/32	21/32	4·643	0·984	1·975	1·812	·371	85·86
50407	5/8	11/16	4·844	1·031	2·062	1·875	·390	85·80
52897	21/32	23/32	5·046	1·078	2·150	1·937	·410	85·75
55383	11/16	3/4	5·248	1·125	2·238	2·000	·429	85·70
57874	23/32	25/32	5·449	1·171	2·325	2·062	·449	85·66
60362	3/4	13/16	5·651	1·218	2·412	2·125	·468	85·62
62847	25/32	27/32	5·853	1·265	2·500	2·187	·488	85·58
65331	13/16	7/8	6·055	1·312	2·588	2·250	·507	85·54
67820	27/32	29/32	6·257	1·359	2·675	2·312	·527	85·51
70307	7/8	15/16	6·459	1·406	2·763	2·375	·546	85·48
72792	29/32	31/32	6·661	1·453	2·850	2·437	·566	85·45
75285	15/16	1	6·864	1·500	2·938	2·500	·585	85·43
77767	31/32	1 1/32	7·066	1·546	3·026	2·562	·605	85·40
80257	1	1 1/16	7·268	1·593	3·114	2·625	·625	85·38
82736	1 1/32	1 3/32	7·470	1·640	3·201	2·687	·644	85·35
85223	1 1/16	1 1/8	7·673	1·687	3·289	2·750	·664	85·33
87709	1 3/32	1 5/32	7·876	1·734	3·377	2·812	·683	85·31
90194	1 1/8	1 3/16	8·078	1·781	3·465	2·875	·703	85·29
92688	1 5/32	1 7/32	8·281	1·828	3·553	2·937	·722	85·28
95171	1 3/16	1 1/4	8·484	1·875	3·641	3·000	·742	85·26
97653	1 7/32	1 9/32	8·686	1·921	3·728	3·062	·761	85·24
100145	1 1/4	1 5/16	8·888	1·968	3·816	3·125	·781	85·23

N = Numeral. D = Diameter of boiler, inside, in inches.
B = Working pressure, in pounds, per square inch. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

FURNACES—PLAIN CYLINDRICAL.

Iron Plates.

Tables Nos. 65 to 77, immediately following, and Nos. 281 to 283, are only intended for furnaces of ordinary diameters when the length does not exceed 10 feet, and for the given thickness of plate at the head of the table. The diameter should never exceed that found in the column opposite the particular pressure. When A1 is the distinguishing letter, Table No. 78 may be used or No. 284.

By the tables, if the diameter is determined, the length, thickness, and pressure can be found; the length can be found if the diameter, thickness, and pressure are determined; the pressure, if the diameter, thickness, and length are known; and when the diameter, length, and pressure are determined, the required thickness can be ascertained.

The numerals in each table, under each distinguishing letter, are those applicable to the circumstances of the case to which the letter refers, and to the thickness of the plate at the head of the table.

The distinguishing letters refer to the method adopted in constructing the furnaces, as the following will explain.

Distinguishing Letters.		Distinguishing Letters.
A1.	Longitudinal seams welded, ...	A1.
A.	Longitudinal seams, double riveted, single butt straps, and holes *drilled*, ...	A.
A	Longitudinal seams, single riveted, double butt straps, and holes *drilled*.	A.
B.	Longitudinal seams, double riveted, single butt straps, and holes *punched*, ...	B.
B.	Longitudinal seams, single riveted, double butt straps, and holes *punched*, ...	B.
C.	Longitudinal seams, single riveted, single butt straps, and holes *drilled*, ...	C.
C.	Longitudinal seams, double riveted, lap joints bevelled, and holes *drilled*, ...	C.
D.	Longitudinal seams, single riveted, single butt straps, and holes *punched*, ...	D.
D.	Longitudinal seams, double riveted, lap joints *not* bevelled, and holes *drilled*, ...	D.
D.	Longitudinal seams, double riveted, lap joints bevelled, and holes *punched*, ...	D.
E.	Longitudinal seams, single riveted, lap joints bevelled, and holes *drilled*, ...	E.
E.	Longitudinal seams, double riveted, lap joints *not* bevelled, and holes *punched*, ...	E.

Distinguishing Letters.		Distinguishing Letters.
F.	Longitudinal seams, single riveted, lap joints *not* bevelled, and holes *drilled*, ...	F.
F.	Longitudinal seams, single riveted, lap joints bevelled, and holes *punched*, ...	F.
G.	Longitudinal seams, single riveted, lap joints *not* bevelled, and holes *punched*, ...	G.

From the foregoing it will be seen that the distinguishing letter A has reference to three different methods of construction, the letter B to two, the letter C to two, the letter D to three, the letter E to two, the letter F to two, and G to one method.

N = Numeral in the tables, applicable to the method of construction.
L = Length of furnace in feet (for the limits of L, see the first paragraph of these notes).
D = Diameter of furnace, in inches, outside.
B = Working pressure, in lbs., per square inch.

(1) The *maximum* diameter in inches of a *horizontal* furnace for any pressure, if the length of the furnace, the thickness of plate, and pressure be determined, may be found by dividing the numeral, in the column applicable to the class of furnace or method of construction and opposite to the given pressure, by the length of furnace in feet, *plus* 1; or the outside diameter in inches should not exceed $\frac{N}{L+1} = D$.

If the thickness of plates be ½ inch, the length 5·25 feet, and the pressure 100 lbs., and the *horizontal* furnace is of the description to which the distinguishing letter A is applicable, and it is required to determine the maximum outside diameter:—

Then, in the table for ½-inch iron plates (No. 73) opposite 100 lbs., the pressure, in the column A, applicable to the case, 225, the numeral is found; and if this be divided by 6·25, the length in feet *plus* 1, the result is 36, which is the greatest outside diameter in inches which the furnace should be,

$$\text{or} \quad \frac{225}{5 \cdot 25 + 1} = 36 = D.$$

(2) The maximum length in feet of a *horizontal* furnace, for any pressure, if the diameter of the furnace and thickness of plate be determined, may be found by dividing the numeral applicable to the class of furnace, or method of construction; and opposite the given pressure, by the diameter in inches, and diminishing the result by 1; or the length should not exceed $\frac{N}{D} - 1 = L$.

If the thickness of the iron plates be ½ inch, the outside diameter 36 inches, and the pressure 100 lbs., and the *horizontal* furnace is of the description to which the distinguishing letter A is applicable, and it is required to determine the greatest length:—

Then, in the table for ½-inch iron plates (No. 73) opposite 100 lbs., the pressure, in the column A applicable to the case, 225, the numeral, is found, and if it be divided by 36, the outside diameter, the result is 6·25, and if this be lessened by 1 it equals 5·25, which is the greatest length in feet the furnace should be,

$$\text{or} \quad \frac{225}{36} = 6{\cdot}25,$$

$$\text{and} \quad 6{\cdot}25 - 1 = 5{\cdot}25 = L.$$

(3) The maximum pressure for any *horizontal* furnace, if the diameter of the furnace, the thickness of plate, and the length be known, may be found by multiplying the diameter in inches by the length in feet, *plus* 1; the result gives the numeral, which should be looked for under the distinguishing letter applicable to the class of furnace or method of construction, and opposite the numeral so arrived at, the greatest pressure is found on the left in the first column on the page,

$$\text{or} \quad D \times (L+1) = N,$$

and the pressure found on the left of the page, opposite the numeral, in the column under the distinguishing letter applicable to the case, is the greatest pressure.

If the thickness of the iron plates be ½ inch, the outside diameter 36 inches, and the length 5·25 feet, and the furnace is of the description to which the distinguishing letter A is applicable, and the greatest working pressure is required to be determined:—

Then, if 36, the outside diameter, be multiplied by 6·25, which is the length, *plus* 1, the result is 225, the numeral, and in the table for ½ inch plate, in column A, applicable to the case, opposite 225 on the left of the page, 100 lbs. pressure is found, which is the greatest working pressure,

$$\text{or} \quad 36 \times (5{\cdot}25 + 1) \text{ or } 36 \times 6{\cdot}25 = 225 = \mathbf{N},$$

and opposite the numeral 225, the pressure found is 100 lbs. $=$ B.

(4) The minimum thickness of the plate of a *horizontal* furnace if the pressure, diameter, and length of furnace and class of furnace, or method of construction, be known, may be found by multiplying the diameter in inches by the length in feet, *plus* 1, which gives the numeral; which numeral should be looked for *opposite* the pressure in a column of the tables under the distinguishing letter applicable to the class of furnace, and if such a number is not found, the next higher number is the numeral to adopt, and at the head of the table the thickness of plate given is the least thickness,

$$\text{or} \quad D \times (L+1) = N.$$

If the outside diameter of a *horizontal* iron furnace be 36 inches, the length 5·25 feet, and the pressure 100 lbs., and the class of furnace

is such as the distinguishing letter A refers to, and the *minimum* thickness of plate is required:—

Then, if 36, the outside diameter, be multiplied by $5{\cdot}25+1=6{\cdot}25$, which is the length increased by 1, the result is 225, which is the numeral; then opposite 100, the pressure, in Column A, of table No. 73, 225 is found, and at the head of the table the thickness is ½ inch, which is the least thickness the plate should be. If the nearest numeral had been in excess of 225, the next higher numeral found opposite 100, the pressure stipulated for, and in Column A, would be the right one to use; for instance, had it been 247, the next higher number found opposite 100, the pressure, is 254, and in the column under the distinguishing letter A, applicable to the circumstances of the case in the example, the thickness of the plate at the head of the table is $^{17}/_{32}$ inch: therefore, the plates would have been required to be practically $^{17}/_{32}$ inch thick.

Furnaces which are found to be too weak may be materially strengthened, so as to be fit for greater pressures, by fitting rings, as properly fitted rings are about equivalent to shortening the length.

(5) If a furnace be *vertical*, its diameter should not exceed ·9 of that suitable for a *horizontal* one of the same dimensions, in other respects and constructed in the same manner.

Thus, if 36 inches is the proper diameter for a *horizontal* furnace,

then, $$36 \times {\cdot}9 = 32{\cdot}4 = D,$$

is the outside diameter, in inches, which the *vertical* furnace should be.

(6) In finding the length of a *vertical* furnace, the appropriate numeral for a *horizontal* one, of the same dimensions and constructed in the same manner, should be multiplied by ·9.

Thus, if 225 be the appropriate numeral for a *horizontal* furnace, and 36 inches the outside diameter,

then, $$\frac{{\cdot}9 \times 225}{36} - 1 = 4{\cdot}625 = L,$$

which is the length the *vertical* furnace should be.

(7) In finding the pressure for a *vertical* furnace, the numeral is found by multiplying the length in feet, *plus* 1, by the outside diameter in inches and *dividing* by ·9. Then, opposite the numeral the pressure will be found in the same way as for a *horizontal* furnace.

(8) In determining the thickness of a *vertical* furnace, having found the numeral by multiplying the length in feet, *plus* 1, by the diameter in inches and *dividing* the result by ·9, the nearest numeral (which should not be less), should be looked for opposite the pressure in the tables and in the column under the distinguishing letter applicable to the construction of the furnace, and the thickness is that at the head of the table.

When the diameter of a *vertical* furnace does not decrease 1 in 12, instead of using the number ·9, alluded to in the former paragraphs, it should be ·85; and if the furnace is parallel, it should not exceed ·8.

FURNACES PLAIN CYLINDRICAL. Table No. 65.

Iron Plates $\frac{1}{4}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	375	354	333	313	292	271	250	72
20	281	266	250	234	219	203	188	70·31
25	225	213	200	188	175	163	150	66·17
30	188	177	167	156	146	135	125	62·5
35	161	152	143	134	125	116	107	59·21
40	141	133	125	117	109	102	93·8	56·25
45	125	118	111	104	97·2	90·3	83·3	50
50	113	106	100	93·8	87·5	81·3	75	45
55	102	96·6	91	85·2	79·5	73·9	68·2	40·9
60	93·8	88·5	83·3	78·1	72·9	67·7	62·5	37·5
65	86·5	81·7	76·9	72·1	67·3	62·5	57·7	34·61
70	80·4	75·9	71·4	67	62·5	58	53·6	32·14
75	75	70·8	66·7	62·5	58·3	54·2	50	30
80	70·3	66·4	62·5	58·6	54·7	50·8	46·9	28·12
85	66·2	62·5	58·8	55·1	51·5	47·8	44·1	26·47
90	62·5	59	55·6	52·1	48·6	45·1	41·7	25
95	59·2	55·9	52·6	49·3	46·1	42·8	39·5	23·68
100	56·3	53·1	50	46·9	43·8	40·6	37·5	22·5
105	53·6	50·6	47·6	44·6	41·7	38·7	35·7	21·42
110	51·1	48·3	45·5	42·6	39·8	36·9	34·1	20·45
115	48·9	46·2	43·5	40·8	38	35·3	32·6	19·56
120	46·9	44·3	41·7	39·1	36·5	33·9	31·3	18·75
125	45	42·5	40	37·5	35	32·5	30	18
130	43·3	40·9	38·5	36·1	33·7	31·3	28·8	17·3
135	41·7	39·4	37	34·7	32·4	30·1	27·8	16·66
140	40·2	37·9	35·7	33·5	31·3	29	26·8	16·07
145	38·8	36·6	34·5	32·3	30·2	28	25·9	15·51
150	37·5	35·4	33·3	31·3	29·2	27·1	25	15
155	36·3	34·3	32·3	30·2	28·2	26·2	24·2	14·51
160	35·2	33·2	31·3	29·3	27·3	25·4	23·4	14·06

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter Table No. 78 may be used when the length does not exceed 1·5 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL. Table No. 66.

Iron Plates $\frac{9}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	356	336	316	297	277	257	237	72
25	285	269	253	237	221	206	190	70·31
30	237	224	211	198	185	171	158	66·17
35	203	192	181	170	158	147	136	62·5
40	178	168	158	148	138	129	119	59·21
45	158	149	141	132	123	114	105	56·25
50	142	134	127	119	111	103	94·9	50·62
55	129	122	115	108	101	93·5	86·3	46·02
60	119	112	105	98·9	92·3	85·7	79·1	42·18
65	110	103	97·4	91·3	85·2	79·1	73	38·94
70	102	96·1	90·4	84·8	79·1	73·5	67·8	36·16
75	94·9	89·6	84·4	79·1	73·8	68·6	63·3	33·75
80	89	84	79·1	74·2	69·2	64·3	59·3	31·64
85	83·8	79·1	74·4	69·8	65·1	60·5	55·8	29·77
90	79·1	74·7	70·3	65·9	61·5	57·1	52·7	28·12
95	74·9	70·8	66·6	62·4	58·3	54·1	50	26·64
100	71·2	67·2	63·3	59·3	55·4	51·4	47·5	25·31
105	67·8	64	60·3	56·5	52·7	49	45·2	24·1
110	64·7	61·1	57·5	53·9	50·3	46·7	43·1	23·01
115	61·9	58·5	55	51·6	48·1	44·7	41·3	22·01
120	59·3	56	52·7	49·4	46·1	42·8	39·6	21·09
125	57	53·8	50·6	47·5	44·3	41·1	38	20·25
130	54·8	51·7	48·7	45·6	42·6	39·6	36·5	19·47
135	52·7	49·8	46·9	43·9	41	38·1	35·2	18·75
140	50·9	48	45·2	42·4	39·6	36·7	33·9	18·08
145	49·1	46·4	43·6	40·9	38·2	35·5	32·7	17·45
150	47·5	44·8	42·2	39·6	36·9	34·3	31·6	16·87
155	45·9	43·4	40·8	38·3	35·7	33·2	30·6	16·33
160	44·5	42	39·6	37·1	34·6	32·1	29·7	15·82

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter Table No. 78 may be used when the length does not exceed 1·812 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL. Table No. 67.

Iron Plates $\frac{5}{16}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	352	332	313	293	273	254	234	72
30	293	277	260	244	228	212	195	70·31
35	251	237	223	209	195	181	167	66·17
40	220	208	195	183	171	159	146	62·5
45	195	184	174	163	152	141	130	59·21
50	176	166	156	146	137	127	117	56·25
55	160	151	142	133	124	115	107	51·13
60	146	138	130	122	114	106	97·7	46·87
65	135	128	120	113	105	97·7	90·1	43·26
70	126	119	112	105	97·7	90·7	83·7	40·17
75	117	111	104	97·7	91·1	84·6	78·1	37·5
80	110	104	97·7	91·6	85·4	79·3	73·2	35·15
85	103	97·7	91·9	86·2	80·4	74·7	68·9	33·08
90	97·7	92·2	86·8	81·4	76	70·5	65·1	31·25
95	92·5	87·4	82·2	77·1	72	66·8	61·7	29·60
100	87·9	83	78·1	73·2	68·4	63·5	58·6	28·12
105	83·7	79·1	74·4	69·8	65·1	60·5	55·8	26·78
110	79·9	75·5	71	66·6	62·1	57·7	53·3	25·56
115	76·4	72·2	67·9	63·7	59·4	55·2	51	24·45
120	73·2	69·2	65·1	61	57	52·9	48·8	23·43
125	70·3	66·4	62·5	58·6	54·7	50·8	46·9	22·5
130	67·6	63·9	60·1	56·3	52·6	48·8	45·1	21·63
135	65·1	61·5	57·9	54·3	50·6	47	43·4	20·83
140	62·8	59·3	55·8	52·3	48·8	45·3	41·9	20·08
145	60·6	57·2	53·9	50·5	47·1	43·8	40·4	19·39
150	58·6	55·3	52·1	48·8	45·6	42·3	39·1	18·75
155	56·7	53·6	50·4	47·3	44·1	41	37·8	18·14
160	54·9	51·9	48·8	45·8	42·7	39·7	36·6	17·57

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter Table No. 78 may be used when the length does not exceed 2·125 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL. TABLE No. 68.

Iron Plates $\frac{11}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
s.								ins.
5	..	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	354	335	315	295	276	256	236	72
35	304	287	270	253	236	219	203	70·31
40	266	251	236	222	207	192	177	66·17
45	236	223	210	197	184	171	158	62·5
50	213	201	189	177	165	154	142	59·21
55	193	183	172	161	150	140	129	56·25
60	177	167	158	148	138	128	118	51·56
65	164	155	145	136	127	118	109	47·59
70	152	143	135	127	118	110	101	44·19
75	142	134	126	118	110	102	94·5	41·25
80	133	126	118	111	103	96	88·6	38·67
85	125	118	111	104	97·3	90·4	83·4	36·39
90	118	112	105	98·5	91·9	85·3	78·8	34·37
95	112	106	99·5	93·3	87·1	80·8	74·6	32·56
100	106	100	94·5	88·6	82·7	76·8	70·9	30·93
105	101	95·7	90	84·4	78·8	73·1	67·5	29·46
110	96·7	91·3	85·9	80·6	75·2	69·8	64·5	28·12
115	92·5	87·3	82·2	77·1	71·9	66·8	61·7	26·9
120	88·6	83·7	78·8	73·9	68·9	64	59·1	25·78
125	85·1	80·4	75·6	70·9	66·2	61·4	56·7	24·75
130	81·8	77·3	72·7	68·2	63·6	59·1	54·5	23·79
135	78·8	74·4	70	65·6	61·3	56·9	52·5	22·91
140	76	71·7	67·5	63·3	59·1	54·9	50·6	22·09
145	73·3	69·3	65·2	61·1	57	53	48·9	21·33
150	70·9	67	63	59·1	55·1	51·2	47·3	20·62
155	68·6	64·8	61	57·2	53·4	49·6	45·7	19·95
160	66·5	62·8	59·1	55·4	51·7	48	44·3	19·33

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter Table No. 78 may be used when the length does not exceed 2·437 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L$. $\frac{N}{L+1} = D$. $(L+1)\ D = N$.

Iron Plates $\frac{3}{8}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maxi-mum
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	..
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	362	342	321	301	281	261	241	72
40	316	299	281	264	246	229	211	70·3
45	281	266	250	234	219	203	188	66·1
50	253	239	225	211	197	183	169	62·5
55	230	217	205	192	179	166	153	59·2
60	211	199	188	176	164	152	141	56·2
65	195	184	173	162	151	141	130	51·9
70	181	171	161	151	141	131	121	48·2
75	169	159	150	141	131	122	113	45
80	158	149	141	132	123	114	105	42·1
85	149	141	132	124	116	108	99·3	39·7
90	141	133	125	117	109	102	93·8	37·5
95	133	126	118	111	104	96·2	88·8	35·5
100	127	120	113	105	98·4	91·4	84·4	33·7
105	121	114	107	100	93·8	87·1	80·4	32·1
110	115	109	102	95·9	89·5	83·1	76·7	30·6
115	110	104	97·8	91·7	85·6	79·5	73·4	29·3
120	105	99·6	93·8	87·9	82	76·2	70·3	28·1
125	101	95·6	90	84·4	78·8	73·1	67.5	27
130	97·4	91·9	86·5	81·1	75·7	70·3	64·9	25·9
135	93·8	88·5	83·3	78·1	72·9	67·7	62·5	25
140	90·4	85·4	80·4	75·3	70·3	65·3	60·3	24·1
145	87·3	82·4	77·6	72·7	67·9	63	58·2	23·2
150	84·4	79·7	75	70·3	65·6	60·9	56·3	22·5
155	81·7	77·1	72·6	68	63·5	59	54·4	21·7
160	79·1	74·7	70·3	65·9	61·5	57·1	52·7	21·0

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 f

* The diameter D should *not* be greater for any given pressure than tha opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 78 may be used when the length does not exceed 2·75 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL. Table No. 70.

Iron Plates $\frac{13}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
s.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	371	351	330	309	289	268	248	72
45	330	312	293	275	257	238	220	70·31
50	297	281	264	248	231	215	198	66·17
55	270	255	240	225	210	195	180	62·5
60	248	234	220	206	193	179	165	59·21
65	229	216	203	190	178	165	152	56·25
70	212	200	189	177	165	153	141	52·23
75	198	187	176	165	154	143	132	48·75
80	186	175	165	155	144	134	124	45·7
85	175	165	155	146	136	126	116	43·01
90	165	156	147	138	128	119	110	40·62
95	156	148	139	130	122	113	104	38·48
00	149	140	132	124	116	107	99	36·56
05	141	134	126	118	110	102	94·3	34·82
10	135	128	120	113	105	97·5	90	33·23
15	129	122	115	108	100	93·3	86·1	31·79
20	124	117	110	103	96·3	89·4	82·5	30·46
25	119	112	106	99	92·4	85·8	79·2	29·25
30	114	108	102	95·2	88·9	82·5	76·2	28·12
35	110	104	97·8	91·7	85·6	79·5	73·4	27·08
40	106	100	94·3	88·4	82·5	76·6	70·7	26·11
45	102	96·7	91·1	85·4	79·7	74	68·3	25·21
50	99	93·5	88	82·5	77	71·5	66	24·37
55	95·8	90·5	85·2	79·9	74·5	69·2	63·9	23·58
60	92·8	87·7	82·5	77·4	72·2	67	61·9	22·85

The length L should never exceed 10 ft. and $\frac{N}{D}-1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that posite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 78 may be used when the ngth does not exceed 3·062 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinuishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D}-1=L.$ $\frac{N}{L+1}=D.$ $(L+1)\ D=N.$

Iron Plates $\frac{7}{16}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maxi-
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								in
5	...	...	...	...	...	...	...	..
10	...	...	...	...	...	...	...	..
15	...	...	...	...	...	...	...	..
20	...	...	...	...	...	...	...	..
25	...	...	...	...	...	...	...	..
30	...	...	...	...	...	...	...	..
35	...	...	...	...	...	...	...	..
40	...	...	...	...	...	...	...	..
45	383	362	340	319	298	276	255	72
50	345	325	306	287	268	249	230	70·
55	313	296	278	261	244	226	209	66·
60	287	271	255	239	223	207	191	62·
65	265	250	236	221	206	191	177	59·
70	246	232	219	205	191	178	164	56·
75	230	217	204	191	179	166	153	52·
80	215	203	191	179	167	156	144	49·
85	203	191	180	169	158	146	135	46·
90	191	181	170	160	149	138	128	43·
95	181	171	161	151	141	131	121	41·
100	172	163	153	144	134	124	115	39·
105	164	155	146	137	128	118	109	37·
110	157	148	139	131	122	113	104	35·
115	150	141	133	125	117	108	99·9	34·
120	144	136	128	120	112	104	95·7	32·
125	138	130	123	115	107	99·5	91·9	31·
130	133	125	118	110	103	95·7	88·3	30·
135	128	121	113	106	99·2	92·2	85·1	29·
140	123	116	109	103	95·7	88·9	82	28·
145	119	112	106	99	92·4	85·8	79·2	27·
150	115	108	102	95·7	89·3	82·9	76·6	26·
155	111	105	98·8	92·6	86·4	80·3	74·1	25·
160	108	102	95·7	89·7	83·7	77·8	71·8	24·

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10

* The diameter D should *not* be greater for any given pressure than th opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter Table No. 78 may be used when t length does not exceed 3·375 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distin guishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL. Table No. 72.

Iron Plates $\frac{15}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

sq. in.	Numerals.							Maxi-mum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
…s.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	396	374	352	330	308	286	264	72
55	360	340	320	300	280	260	240	70·31
60	330	311	293	275	256	238	220	66·17
65	304	287	270	254	237	220	203	62·5
70	283	267	251	235	220	204	188	59·21
75	264	249	234	220	205	190	176	56·25
80	247	233	220	206	192	179	165	52·73
85	233	220	207	194	181	168	155	49·63
90	220	208	195	183	171	159	146	46·87
95	208	197	185	173	162	150	139	44·4
100	198	187	176	165	154	143	132	42·18
105	188	178	167	157	146	136	126	40·17
110	180	170	160	150	140	130	120	38·35
115	172	162	153	143	134	124	115	36·68
120	165	156	146	137	128	119	110	35·15
125	158	149	141	132	123	114	105	33·75
130	152	144	135	127	118	110	101	32·45
135	146	138	130	122	114	106	97·7	31·25
140	141	133	126	118	110	102	94·2	30·13
145	136	129	121	114	106	98·5	90·9	29·09
150	132	125	117	110	103	95·2	87·9	28·12
155	128	120	113	106	99·2	92·1	85·1	27·21
160	124	117	110	103	96·1	89·3	82·4	26·36

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that pposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter Table No. 78 may be used when the ngth does not exceed 3·687 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinuishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

Iron Plates $\frac{1}{2}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	409	386	364	341	318	295	273	72
60	375	354	333	313	292	271	250	70·31
65	346	327	308	288	269	250	231	66·17
70	321	304	286	268	250	232	214	62·5
75	300	283	267	250	233	217	200	59·21
80	281	266	250	234	219	203	188	56·25
85	265	250	235	221	206	191	176	52·94
90	250	236	222	208	194	181	167	50
95	237	224	211	197	184	171	158	47·36
100	225	213	200	188	175	163	150	45
105	214	202	190	179	167	155	143	42·85
110	205	193	182	170	159	148	136	40·9
115	196	185	174	163	152	141	130	39·13
120	188	177	167	156	146	135	125	37·5
125	180	170	160	150	140	130	120	36
130	173	163	154	144	135	125	115	34·61
135	167	157	148	139	130	120	111	33·33
140	161	152	143	134	125	116	107	32·14
145	155	147	138	129	121	112	103	31·03
150	150	142	133	125	117	108	100	30
155	145	137	129	121	113	105	96·8	29·03
160	141	133	125	117	109	102	93·8	28·12

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 78 may be used when the length does not exceed 4 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL. TABLE No. 74.

Iron Plates $\frac{17}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	..
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	423	400	376	353	329	306	282	72
65	391	369	347	326	304	282	261	70·31
70	363	343	323	302	282	262	242	66·17
75	339	320	301	282	263	245	226	62·5
80	318	300	282	265	247	229	212	59·21
85	299	282	266	249	232	216	199	56·25
90	282	267	251	235	220	204	188	53·12
95	267	253	238	223	208	193	178	50·32
100	254	240	226	212	198	183	169	47·81
105	242	228	215	202	188	175	161	45·53
110	231	218	205	192	180	167	154	43·46
115	221	209	196	184	172	160	147	41·59
120	212	200	188	176	165	153	141	39·84
125	203	192	181	169	158	147	135	38·25
130	195	185	174	163	152	141	130	36·77
135	188	178	167	157	146	136	125	35·41
140	181	171	161	151	141	131	121	34·15
145	175	165	156	146	136	127	117	32·97
150	169	160	151	141	132	122	113	31·87
155	164	155	146	137	127	118	109	30·84
160	159	150	141	132	123	115	106	29·88

The length L should never exceed 10 ft., and $\frac{N}{D}-1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 78 may be used when the length does not exceed 4·312 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D}-1=L.$ $\frac{N}{L+1}=D.$ $(L+1)\,D=N.$

FURNACES PLAIN CYLINDRICAL. TABLE No. 75.

Iron Plates $\frac{9}{16}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	..	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
65	438	414	389	365	341	316	292	72
70	407	384	362	339	316	294	271	70·31
75	380	359	338	316	295	274	253	66·17
80	356	336	316	297	277	257	237	62·5
85	335	316	298	279	261	242	223	59·21
90	316	299	281	264	246	229	211	56·25
95	300	283	266	250	233	216	200	53·28
100	285	269	253	237	221	206	190	50·62
105	271	256	241	226	211	196	181	48·21
110	259	244	230	216	201	187	173	46·02
115	248	234	220	206	193	179	165	44·02
120	237	224	211	198	185	171	158	42·18
125	228	215	203	190	177	165	152	40·50
130	219	207	195	183	170	158	146	38·94
135	211	199	188	176	164	152	141	37·50
140	203	192	181	170	158	147	136	36·16
145	196	185	175	164	153	142	131	34·91
150	190	179	169	158	148	137	127	33·75
155	184	174	163	153	143	133	122	32·66
160	178	168	158	148	138	129	119	31·64

The length L should never exceed 10 ft. and $\frac{N}{D}-1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter Table No. 78 may be used when the length does not exceed 4·625 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D}-1=L.$ $\frac{N}{L+1}=D.$ $(L+1)\ D=N.$

FURNACES PLAIN CYLINDRICAL. TABLE No. 76.

Iron Plates $\frac{19}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...
70	453	428	403	378	353	327	302	72
75	423	400	376	353	329	306	282	70·31
80	397	375	353	331	308	286	264	66·17
85	373	353	332	311	290	270	249	62·5
90	353	333	313	294	274	255	235	59·21
95	334	315	297	278	260	241	223	56·25
100	317	300	282	264	247	229	212	53·43
105	302	285	269	252	235	218	201	50·89
110	288	272	256	240	224	208	192	48·57
115	276	261	245	230	215	199	184	46·46
120	264	250	235	220	206	191	176	44·53
125	254	240	226	212	197	183	169	42·75
130	244	231	217	203	190	176	163	41·10
135	235	222	209	196	183	170	157	39·58
140	227	214	201	189	176	164	151	38·16
145	219	207	195	182	170	158	146	36·85
150	212	200	188	176	165	153	141	35·62
155	205	193	182	171	159	148	136	34·47
160	198	187	176	165	154	143	132	33·39

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter Table No. 78 may be used when the length does not exceed 4·937 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL. TABLE No. 77.
Iron Plates $\frac{5}{8}$ inch thick.
Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	..	...	...	...	...	...	...	..
65	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...
75	469	443	417	391	365	339	313	72
80	439	415	391	366	342	317	293	70·31
85	414	391	368	345	322	299	276	66·17
90	391	369	347	326	304	282	260	62·5
95	370	350	329	308	288	267	247	59·21
100	352	332	313	293	273	254	234	56·25
105	335	316	298	279	260	242	223	53·57
110	320	302	284	266	249	231	213	51·13
115	306	289	272	255	238	221	204	48·91
120	293	277	260	244	228	212	195	46·87
125	281	266	250	234	219	203	188	45
130	270	255	240	225	210	195	180	43·26
135	260	246	231	217	203	188	174	41·66
140	251	237	223	209	195	181	167	40·17
145	242	229	216	202	189	175	162	38·79
150	234	221	208	195	182	169	156	37·5
155	227	214	202	189	176	164	151	36·29
160	220	208	195	183	171	159	146	35·15

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 78 may be used when the length does not exceed 5·25 feet; above 160 lbs., see Table No. 284.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES WITH FLANGED JOINTS.

Iron Plates from ¼ inch to ⅝ inch thick.

Table No. 78, immediately following, and No. 284, are only for furnaces of ordinary diameters, made of rings welded longitudinally and flanged at the ends, and, when there is more than one ring, riveted together so as to form a complete furnace, and for furnaces whose length is equal to or shorter than that given opposite the thickness, being dealt with and found in the column "maximum lengths for thickness."

These Tables are only intended for furnaces made of the *highest* quality of iron, and when the length, or the distance, between the centres of flanges of the rings, when they are made of more than one ring, does not exceed that given in the column headed "maximum lengths for thickness;" when the length, or the distance, between the rings exceeds that given, the pressure or other particulars should be found from the Tables Nos. 65 to 77, or Nos. 271 to 283.

N = Numeral for pressure.
C = Constant for thickness.
D = Diameter of furnace, in inches, outside.
l = Length or distance between centres of flanges, in inches.
B = Working pressure, in lbs., per square inch.

$$\frac{C-l}{N} = D.$$

$$C - ND = l.$$

$$ND + l = C.$$

$$\frac{C-l}{D} = N.$$

(1) The maximum diameter a furnace should be for a given working pressure, if the thickness of iron plate and the length, or the distance, in inches, between the centres of the flanges be known, may be found by subtracting the length, or the distance, between the centres of flanges, *in inches*, from the thickness constant opposite the *given* thickness, and dividing the result by the numeral opposite the *given* pressure; or, the diameter should not exceed $\frac{C-l}{N}$.

If the thickness of the iron plates of a furnace be $\frac{9}{16}$ inch, the length, or the distance, between the centres of flanges 24 inches, the pressure required 150 lbs., and the maximum diameter has to be determined:—

Then, if 24, the length, or distance, in inches, between the centres of flanges, be subtracted from 156·75, the constant found opposite the thickness, and the remainder divided by 3, the

numeral found opposite the pressure, 150, the result is the maximum outside diameter the furnace should be,

$$\text{or } \frac{156{\cdot}75 - 24}{3} = 44{\cdot}25 = D,$$

or 44¼ inches.

(2) The maximum length, or the distance, in inches, between the centres of the flanges of a furnace, can be determined if the working pressure, thickness of iron plates, and diameter are known, by multiplying the numeral, opposite the given pressure, by the diameter and subtracting the product from the thickness constant opposite the given thickness; or, the length, or distance, in inches, between the centres of flanges, should not exceed $C - ND$.

If the working pressure is required to be 135 lbs., the thickness of the iron plate ½ inch, and the outside diameter 34 inches, and the maximum length, or distance, in inches, between the centres of flanges has to be determined :—

Then if 2·7, the numeral found opposite the pressure, 135, be multiplied by 34, the diameter, and the product subtracted from 138, the constant found opposite the thickness, ½, the remainder is the maximum length, or distance, in inches, between the centres of the flanges,

$$\text{or, } 2{\cdot}7 \times 34 = 91{\cdot}8,$$
$$\text{and } 138 - 91{\cdot}8 = 46{\cdot}2 = l,$$

or the maximum length should be, say, 46¼ inches.

(3) The minimum thickness of iron plates of a furnace can be determined if the working pressure, diameter and length, or distance, in inches, between the centres of the flanges, be known, by adding the length, or distance, in inches, between the centres of the flanges to the product of the diameter and the numeral opposite the given pressure; or, the thickness constant should not exceed $ND + l$.

If the working pressure is required to be 100 lbs., the outside diameter 38 inches, and the length, or distance, between the centres of flanges 24 inches, and the minimum thickness of the iron plate has to be determined :—

Then if 24, the length, be added to the product of 2 the numeral found opposite 100, the working pressure, and 38 the diameter, the result is 100, which is practically the constant found opposite ⅜, the thickness,

$$\text{or, } 2 \times 38 + 24 = 100 = C,$$

which gives ⅜ inch, the thickness of the plate.

(4) The working pressure for a furnace made of iron plates, if the thickness, diameter, and length, or distance, in inches, between the centres of the flanges, is known, may be found opposite the numeral obtained by subtracting the length, in inches, from the thickness

constant, opposite the given thickness, and dividing by the diameter; or, the numeral should not be greater than $\frac{C - l}{D}$.

(5) If the thickness of the iron plate be $\frac{7}{16}$ inch, the outside diameter 36 inches, and the length, or distance, between the centres of the flanges 20 inches, and the working pressure is required to be determined :—

Then, if 20, the length, or distance, in inches, between the centres of the flanges, be subtracted from 119·25, the constant opposite $\frac{7}{16}$, the thickness, and the remainder divided by 36, the diameter, the result is the numeral opposite which the working pressure is found,

$$\text{or, } 119{\cdot}25 - 20 = 99{\cdot}25.$$

$$\text{and } \frac{99{\cdot}25}{36} = 2{\cdot}756 = N,$$

which is slightly in excess of the numeral found opposite 135 lbs. pressure; therefore, the working pressure is, say, 135 lbs. = B.

When furnaces are made with flanged joints, it is well to have the radius of the flange on the fire side about 1·5 inch.

The flanges should be kept as near the original thickness of the plate as is practicable, and after all heating, welding, and flanging is completed, the lengths should be efficiently annealed before being riveted. If there are any signs of defects in the flanging, the defective length should not on any account be used.

The distance between the edges of the rivet holes to the edges of the flange should not be less than the diameter of the rivet. The rivets should be of good size, the diameter at least $\frac{3}{8}$ inch more than the thickness of the plates, and the heads should not be too large. The depth of the strip or ring between the flanges should not be less than three times the diameter of the rivets, and the thickness may be about one half the thickness of the furnace plates. To make a first-class job the ring should be turned.

The holes in the flanges should be drilled; but when not drilled in place, they should be drilled sufficiently less in diameter to insure that when rimered out, fair and perfect holes are formed. It is advisable to have a little taper in the holes in each flange; this will allow the heads of the rivets to be kept of moderate size.

So long as the pressure and diameter remain the same, then for every thirty-second of an inch the plate is increased in thickness, the length between the centres of the flanges may be increased about 9$\frac{3}{8}$ inches, provided it does not exceed the length in column "Maximum Lengths for Thickness in Inches" opposite the thickness being dealt with. See Table No. 78.

These notes and the Table which follows are only intended for furnaces which are flanged by a suitable machine and one flange completed at one heat.

FURNACES WITH FLANGED JOINTS.

TABLE No. 78.

Iron Plates from $\frac{1}{4}$ inch to $\frac{5}{8}$ inch thick.

Pressure per sq. in.	† Pressure Numerals.
lbs.	N.
5	...
10	...
15	...
20	...
25	...
30	...
35	...
40	...
45	·9
50	1·0
55	1·1
60	1·2
65	1·3
70	1·4
75	1·5
80	1·6
85	1·7
90	1·8
95	1·9
100	2·0
105	2·1
110	2·2
115	2·3
120	2·4
125	2·5
130	2·6
135	2·7
140	2·8
145	2·9
150	3·0
155	3·1
160	3·2

Constants and Maximum Lengths for the Thicknesses which they are opposite.		
Thickness.	Constants.	*Maximum Lengths for Thickness in inches.
Inches.	C	
1/4	63·0	18·0
9/32	72·375	21·75
5/16	81·75	25·50
11/32	91·125	29·25
3/8	100·50	33·0
13/32	109·875	36·75
7/16	119·25	40·50
15/32	128·625	44·25
1/2	138·0	48·0
17/32	147·375	51·75
9/16	156·75	55·50
19/32	166·125	59·25
5/8	175·50	63·0

* The lengths opposite the thickness in each case are the maximum lengths, in inches, between the centres of the flanges, for which the Tables should be used. When the length exceeds that opposite the given thickness then the pressure may be found from Tables Nos. 65 to 77.

N = Pressure numeral. C = Thickness constant. D = Diameter, outside, in inches.
l = Length between centres of flanges, in inches. † Above 160 lbs., see Table 284.

$$\frac{C-l}{N} = D. \quad C-ND = l. \quad ND+l = C. \quad \frac{C-l}{D} = N.$$

FURNACES, CORRUGATED, CYLINDRICAL.

Iron Plates from ¼ inch to ⅝ inch thick.

By the Tables Nos. 79 and 80, immediately following, and No. 285, the maximum diameter, the working pressure, and the thickness of the plate, can be determined when the plates, of which the furnaces are made, are of the *highest* quality.

The tables are only intended for furnaces which are machine-made and when the pitch of the corrugations is 6 inches, the depth from top of corrugation outside, to bottom of corrugation inside, not less than 2 inches, and the plain parts at the ends not more than 6 inches in length. When the corrugations are not made by machine, the working pressure should not be so great as that found by the tables, as furnaces, when they are not corrugated by a machine, are not so reliable.

The mean diameter, for the purpose of determining the pressure or thickness, is half the sum of the two outside diameters, the one being that measured from the top of the corrugations, the other from the bottom of the corrugations; or, the sum of the maximum and minimum diameters inside, *plus* four times the thickness of the plate divided by two, equals the mean diameter.

D = Mean diameter, in inches.
T = Thickness, in inches.
B = Working pressure, in lbs., per square inch.

The maximum mean diameter, in inches, to which corrugated furnaces should be made, if constructed of iron plates of the *highest* quality, the thickness of plate and the working pressure being determined, is found in the column under the given thickness of plate, and opposite the given pressure; or if the pressure and diameter be determined, the thickness to which the plate should be made is found at the head of the column above the given diameter, opposite the given pressure; or the pressure for a known thickness and diameter is that found opposite such diameter in the column under the given thickness.

If the pressure is required to be 100 lbs., and the thickness of the iron plate is ½ inch, and the maximum mean diameter is required:—

Then, opposite 100 lbs., the pressure, and in the column under ½ inch, the thickness, 45 is found, which is the maximum mean diameter in inches.

$$45 = D.$$

If the pressure is required to be 100 lbs., the mean diameter 45 inches, and the thickness of the iron plate has to be determined:—

Then, opposite 100 lbs., the pressure, 45, the diameter, is found in the column under ½ inch, which is the minimum thickness the iron plate should be,

$$\tfrac{1}{2} \text{ inch} = T.$$

If the working pressure has to be determined when the thickness of the iron plate is ½ inch and the mean diameter is 45 inches:—

> Then, in the column under ½ inch, the thickness, 45, the diameter, is found, and opposite it the pressure is 100 lbs., which is the maximum working pressure in lbs.

$$100 = B.$$

If the plates of which iron corrugated furnaces are made, are not entirely free from laminations, they will be sure to become defective at a very early period of their existence.

 FURNACES, CORRUGATED, CYLINDRICAL. TABLE No. 79.

Iron Plates from ¼ inch to 7/16 inch thick.
Pressures and Diameters when *Machine* made.

Pressure per square inch.	Thicknesses and Diameters.*						
	¼ in.	9/32 in.	5/16 in.	11/32 in.	⅜ in.	13/32 in.	7/16 in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs.							
5	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...
25	..	...	...	...	...	...	...
30	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...
40	56·25	...	...	...	...	...	...
45	50·0	56·25	...	...	...	...	...
50	45·0	50·62	56·25	...	...	...	...
55	40·9	46·02	51·13	56·25	...	...	...
60	37·5	42·18	46·87	51·56	56·25	...	...
65	34·61	38·94	43·26	47·59	51·92	56·25	...
70	32·14	36·16	40·17	44·19	48·21	52·23	56·25
75	30·0	33·75	37·5	41·25	45·0	48·75	52·5
80	28·12	31·64	35·15	38·67	42·18	45·7	49·21
85	26·47	29·77	33·08	36·39	39·70	43·01	46·32
90	25·0	28·12	31·25	34·37	37·5	40·62	43·75
95	23·68	26·64	29·60	32·56	35·52	38·48	41·44
100	22·5	25·31	28·12	30·93	33·75	36·56	39·37
105	21·42	24·10	26·78	29·46	32·14	34·82	37·5
110	20·45	23·01	25·56	28·12	30·68	33·23	35·79
115	19·56	22·01	24·45	26·90	29·34	31·79	34·23
120	18·75	21·09	23·43	25·78	28·12	30·46	32·81
125	18·0	20·25	22·5	24·75	27·0	29·25	31·5
130	17·3	19·47	21·63	23·79	25·96	28·12	30·28
135	16·66	18·75	20·83	22·91	25·0	27·08	29·16
140	16·07	18·08	20·08	22·09	24·10	26·11	28·12
145	15·51	17·45	19·39	21·33	23·27	25·21	27·15
150	15·0	16·87	18·75	20·62	22·5	24·37	26·25
155	14·51	16·33	18·14	19·95	21·77	23·58	25·4
160	14·06	15·82	17·57	19·33	21·09	22·85	24·6

* The diameter is the *mean* diameter, which is half the sum of the outside diameters, the one being that measured from the top of the corrugations, the other from the bottom of the corrugations.

FURNACES, CORRUGATED, CYLINDRICAL.

TABLE No. 80.

Iron Plates from $^{15}/_{32}$ inch to $5/8$ inch thick.
Pressures and Diameters when *Machine* made.

Pressure per square inch.	Thicknesses and Diameters.*					
	$^{15}/_{32}$ in.	$1/2$ in.	$^{17}/_{32}$ in.	$9/16$ in.	$^{19}/_{32}$ in.	$5/8$ in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs.						
5	...	...	...	...	...	...
10	...	...	...	...	...	...
15	...	...	...	...	...	...
20	...	...	...	...	...	...
25	...	...	...	...	...	...
30	...	...	...	...	...	...
35	...	...	...	...	...	...
40	...	...	...	...	...	...
45	...	...	...	...	...	...
50	...	...	...	...	...	...
55	...	...	...	...	...	...
60	...	...	...	...	...	...
65	...	...	...	...	...	...
70	...	...	...	...	...	...
75	56·25	...	...	...	...	...
80	52·73	56·25	...	...	...	...
85	49·63	52·94	56·25	...	...	...
90	46·87	50·0	53·12	56·25	...	...
95	44 40	47·36	50·32	53·28	56·25	...
100	42·18	45·0	47·81	50·62	53·43	56·25
105	40·17	42·85	45·53	48·21	50·89	53·57
110	38·35	40·90	43·46	46·02	48·57	51·13
115	36·68	39·13	41·57	44·02	46·46	48·91
120	35·15	37·5	39·84	42·18	44·53	46·87
125	33·75	36·0	38·25	40·5	42·75	45·0
130	32·45	34·61	36·77	38·94	41·1	43·26
135	31·25	33·33	35·41	37·5	39·58	41·66
140	30·13	32·14	34·15	36·16	38·16	40·17
145	29·09	31·03	32·97	34·91	36·85	38·79
150	28·12	30·0	31·87	33·75	35·62	37·5
155	27·21	29·03	30·84	32·66	34·47	36·29
160	26·36	28·12	29·88	31·64	33·39	35 15

* The diameter is the *mean* diameter, which is half the sum of the outside diameters, the one being that measured from the top of the corrugations, the other from the bottom of the corrugations.

FLAT SURFACES, PRESSURES, PITCHES, AND SURFACES.

Steel Plates.

In the Tables Nos. 81 to 109, which immediately follow, and Nos. 286 to 314, pitches are given from about 21 inches to 3½ inches, and surfaces, from about 440 square inches to 12½ square inches, with the thickness of plates and pressures suitable for the different pitches and surfaces, according to the particular conditions under which the pressures, pitches, and surfaces are applicable. The pressures range from 5 lbs. to 200 lbs. per square inch. The thicknesses of the plates range from ¼ to 1⅛ inch, each Table advancing by $\frac{1}{32}$ of an inch.

The following notes and remarks will facilitate the use of the Tables Nos. 81 to 109, also Nos. 286 to 314.

The distinguishing letters over the different columns in each table, refer to the conditions under which the pitches and surfaces are suitable for the working pressure, opposite the particular pitch and surface, when the plates are of the thickness given at the head of the table; and consequently opposite the particular pressure will be found the pitches and surfaces suitable for the working pressure for the thickness of plate at the head of the table.

The following are the conditions to which each distinguishing letter in the tables refers, showing under which distinguishing letter the pitches and surfaces should be looked for in the table for the suitable thickness of plate.

Distinguishing Letters.		Distinguishing Letters.
A_1.	If the plates are *not* exposed to the impact of heat or flame, and the stays are fitted with nuts and strips of at least the thickness of the plates they cover, and of a width not less than ⅔ the pitch of the stays, and the strips are properly riveted to the outside of the plates, then the maximum working pressure is that found opposite the pitch or surface in column, ...	A_1.
B_1.	If the plates are *not* exposed to the impact of heat or flame, and the stays are fitted with nuts and washers of at least the thickness of the plates they cover, and of a diameter not less than ⅔ the pitch of the stays, and the washers are properly riveted on the outside of the plates, then the maximum working pressure is that found opposite the pitch or surface in column, . .	B_1.

Distinguishing Letters. | Distinguishing Letters.

C_1. If the plates are *not* exposed to the impact of heat or flame, and the stays are fitted with nuts and washers of at least ⅔ the thickness of the plates they cover, and of a diameter of not less than 3 times the diameter of the stay, over the thread, then the maximum working pressure is that found opposite the pitch or surface in column, ... C_1.

D_1. If the plates are *not* exposed to the impact of heat or flame, and the stays are fitted with nuts only, then the maximum working pressure is that found opposite the pitch or surface in column, ... D_1.

E_1. If the plates are exposed to the impact of heat or flame, and water is in contact with the plates, and the stays are screwed into the plates and fitted with nuts, then the maximum working pressure is that found opposite the pitch or surface in column, ... E_1.

F_1G_1. If the plates are *not* exposed to the impact of heat or flame, and water is in contact with the plates, and the stays are screwed into the plates, and the ends of the stays are riveted over, so that substantial heads are formed, then the maximum working pressure is that found opposite the pitch or surface in column, ... F_1G_1.

F_1G_1. If the plates are exposed to the impact of heat or flame, and steam is in contact with the plates, and the stays are fitted with nuts and washers of at least ⅔ the thickness of the plates they cover, and of a diameter not less than 3 times the diameter of the stay, over the thread, then the maximum working pressure is that found opposite the pitch or surface in column, ... F_1G_1.

r G_1. If the plates are exposed to the impact of heat or flame, and water is in contact with the plates, and the stays are screwed into the plates, and the ends of the stays are riveted over, so that substantial heads are formed, then the maximum working pressure is that found opposite the pitch or surface in column, . . . r G_1.

Distinguishing Letters.		Distinguishing Letters.
H_1.	If the plates are exposed to the impact of heat or flame, and steam is in contact with the plates, and the stays are fitted with nuts only, then the maximum working pressure is that found opposite the pitch or surface in column, ...	H_1.
I_1.	If the plates are exposed to the impact of heat or flame, and steam is in contact with the plates, and the stays are screwed into the plates, and the ends of the stays are riveted over, so as to form substantial heads, then the maximum working pressure is that found opposite the pitch or surface in column, ...	I_1.

In any case where the material or workmanship is defective, or the nuts or ends of the stays, &c., are defective, the working pressure should be less than that found opposite the pitches and surfaces which are applicable for cases where all is first-class as to material, workmanship, and condition.

The following examples will further facilitate the use of the tables:—

(1) To find the working pressure for a given thickness of steel plate and a given pitch or surface.

If the steel plate be $\frac{9}{16}$ inch thick, the surface 256 and pitch 16 inches, and the conditions of the case make the surface and pitch in column B_1 applicable: then, in Table No. 91, which is for $\frac{9}{16}$ inch steel plates in column B_1, the surface 256 is found, and the pitch is 16 inches, opposite which the pressure is found to be 75 lbs. per square inch.

(2) To find the pitch or surface for a given pressure and a given thickness of steel plate.

If the steel plate be $\frac{9}{16}$ inch thick, and the pressure 75 lbs. per square inch, and the conditions of the case make it necessary to select the surface in column B_1: then, in Table No. 91, which is for $\frac{9}{16}$ inch steel plates, opposite 75 lbs. in column B_1, is found 256, which is the surface in square inches, the pitch being 16 inches.

(3) To find the thickness of steel plate for a given pitch or surface and a given pressure.

If the surface be 256 square inches, and the pressure 75 lbs. per square inch, and the conditions of the case make it necessary to select the surface or pitch in column B_1: then, opposite 75 lbs. pressure, the surface 256 and pitch 16 inches are found in column B_1 in Table No. 91, and the thickness of steel plate is found to be $\frac{9}{16}$ inch.

Or, if W = working pressure, p = pitch, S = surface, and T = thickness of steel plate, and if A_1—B_1—C_1—D_1—E_1—F_1G_1—r G_1—H_1 and I_1, are the letters at the heads of the different columns, indicating the columns where the surface applicable to the case must be looked for, then :—

(1) To find W——when T = 9/16 inch, S = 256, p = 16, and B_1 the distinguishing letter of column from which the surface or pitch must be selected.

In the Table No. 91 for 9/16 inch steel plates in column B_1 the surface 256 is found, and opposite the surface is 75 lbs., which is the working pressure required to be found.

(2) To find S or p——when T = 9/16 inch, W = 75 lbs., and B_1 the distinguishing letter of column, in which the surface or pitch must be looked for.

In the Table No. 91 for 9/16 inch steel plates, opposite 75 lbs. in column B_1, 256 and 16 are found, which are the surface and pitch required.

(3) To find T——when W = 75 lbs., S = 256, p = 16, and B_1 the distinguishing letter of column in which the surface must be selected :—

The surface and pitch are large, but as the pressure is only moderately high and there are riveted washers. the steel plates need not be thick, and on looking down the Table No. 91 for 9/16 inch steel plates, opposite 75 lbs. in column B_1 are found 256 and 16, therefore = T 9/16 inch, which is the thickness of steel plate required to be found.

If in any of the foregoing examples the pitches only, or the surfaces only had been under consideration instead of both pitches and surfaces, the method of ascertaining either would have been exactly the same ; as the pitches and surfaces are in each case given opposite the pressure under the distinguishing letter applicable to the case.

The pitches are given in inches and decimal parts of an inch, the latter can, if required, be easily converted into vulgar fractions, and when this is done, if the decimal part is not found equal to, say, 1/16 part of an inch, it is advisable in practice to make the pitch to the sixteenth below, and such a small difference will be on the side of safety. If, for example, the pitch in the Table be 10·77 inches, it may in practice be 10¾ inches, if vulgar fractions be preferred to decimals.

As it is desirable that flat surfaces should be supported by stays forming squares, the following tables have been prepared for surfaces with stays pitched in squares or nearly so. When, however, there is a *considerable* difference in the pitches, it is thought prudent that the

pressure should *not* be so great; therefore, when the surface to be supported is obtained by the product of two pitches which are *considerably* different, the pressure which may be used will *not* be that opposite the surface, but may be easily found.

For example :—

If the pitches are as 4 to 3, the pressure opposite the surface or product of the two pitches may be reduced about 4 per cent.; when as 3 to 2, about 8 per cent.; when as 5 to 3 about 12 per cent.; and when as 2 to 1, the reduction of pressure may be about 20 per cent

The thicknesses given in the Tables are intended to provide for stresses due to the steam pressure upon the stayed flat plate, and when a flat plate is subjected to additional stresses, these should be duly considered ; such additional stresses may be tensile or compressive ; in both cases the thickness of the plate should be adequately increased, or other efficient means adopted to meet the requirements of the case.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{1}{4}$ inch thick.

Pressure per sq. in.	$^*A_1$		$^*B_1$		$^*C_1$		$^*D_1$		$^*E_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	17·84	318·5	16·94	287·2	16·00	256·0
15	18·42	339·3	17·84	318·5	14·64	214·3	13·91	193·5	13·14	172·6
20	16·00	256·0	15·50	240·3	12·73	162·2	12·10	146·6	11·44	131·0
25	14·35	206·0	13·91	193·5	11·44	131·0	10·88	118·5	10·29	106·0
30	13·14	172·6	12·73	162·2	10·49	110·1	9·98	99·7	9·45	89·3
35	12·20	148·8	11·83	139·9	9·76	95·2	9·29	86·3	8·80	77·4
40	11·44	131·0	11·09	123·1	9·17	84·1	8·73	76·3	8·27	68·5
45	10·82	117·1	10·49	110·1	8·68	75·4	8·27	68·5	7·84	61·5
50	10·29	106·0	9·98	99·7	8·27	68·5	7·89	62·2	7·48	56·0
55	9·84	96·9	9·55	91·2	7·92	62·8	7·55	57·1	7·17	51·4
60	9·45	89·3	9·17	84·1	7·62	58·0	7·27	52·8	6·90	47·6
65	9·10	82·9	...	...	7·35	54·0	7·02	49·2	6·66	44·4
70	...	...	...	...	7·11	50·6	6·79	46·1	6·45	41·7
75	...	...	...	...	6·90	47·6	6·59	43·5	6·27	39·3
80	...	...	...	...	6·71	45·0	6·41	41·1	6·09	37·1
85	...	...	...	...	6·54	42·7	6·25	39·0	5·88	34·5
90	...	...	...	...	6·38	40·7	6·09	37·1	5·69	32·3
95	...	...	...	...	6·23	38·8	5·90	34·8	5·52	30·4
100	...	...	...	...	6·09	37·1	5·73	32·8	5·36	28·7
105	...	...	...	...	5·92	35·0	5·57	31·0	5·22	27·3
110	...	...	...	...	5·76	33·2	5·43	29·5	5·10	26·0
115	...	...	...	...	5·62	31·5	5·30	28·1	4·98	24·8
120	...	...	...	...	5·48	30·1	5·18	26·8	4·88	23·8
125	...	...	...	...	5·36	28·7	5·07	25·7	4·78	22·8
130	...	...	...	...	5·25	27·6	4·97	24·7	4·69	22·0
135	...	...	...	...	5·15	26·5	4·88	23·8	4·61	21·2
140	...	...	...	...	5·05	25·5	4·79	22·9	4·53	20·5
145	...	...	...	...	4·96	24·6	4·71	22·2	4·46	19·9
150	...	...	...	...	4·88	23·8	4·63	21·5	4·39	19·3
155	...	...	...	...	4·80	23·0	4·56	20·8	4·33	18·7
160	...	...	...	...	4·72	22·3	4·50	20·2	4·27	18·2
	$^*A_1$		$^*B_1$		$^*C_1$		$^*D_1$		$^*E_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 81 *continued.*

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{1}{4}$ inch thick.

Pressure per sq. in.	$^*F_1G_1$		$^*H_1$		$^*r\ G_1$		$^*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	19·52	381·0	18·53	343·5	18·33	336·0	14·28	204·0
10	13·91	193·5	13·22	174·7	13·07	171·0	10·24	105·0
15	11·44	131·0	10·88	118·5	10·77	116·0	8·48	72·0
20	9·98	99·7	9·50	90·3	9·40	88·5	7·45	55·5
25	9·00	81·0	8·57	73·5	8·48	72·0	6·75	45·6
30	8·27	68·5	7·89	62·2	7·81	61·0	6·24	39·0
35	7·71	59·5	7·36	54·2	7·29	53·1	5·75	33·0
40	7·27	52·8	6·94	48·1	6·87	47·2	5·33	28·4
45	6·90	47·6	6·59	43·5	6·53	42·6	5·01	25·1
50	6·59	43·5	6·30	39·7	6·24	39·0	4·76	22·6
55	6·33	40·0	6·03	36·3	5·95	35·4	4·55	20·7
60	6·09	37·1	5·73	32·8	5·65	32·0	4·37	19·1
65	5·81	33·8	5·47	30·0	5·41	29·2	4·22	17·8
70	5·57	31·0	5·26	27·6	5·20	27·0	4·10	16·8
75	5·36	28·7	5·07	25·7	5·01	25·1	3·98	15·8
80	5·18	26·8	4·91	24·1	4·85	23·5	3·85	14·8
85	5·02	25·2	4·76	22·7	4·71	22·2	3·73	13·9
90	4·88	23·8	4·63	21·5	4·58	21·0	3·63	13·2
95	4·75	22·5	4·52	20·4	4·47	20·0	3·53	12·5
100	4·63	21·5	4·41	19·5	4·37	19·1	...	...
105	4·53	20·5	4·32	18·7	4·28	18·3	...	...
110	4·43	19·7	4·24	17·9	4·20	17·6	...	...
115	4·35	18·9	4·16	17·3	4·12	17·0	...	...
120	4·27	18·2	4·09	16·7	4·05	16·4	...	...
125	4·20	17·6	4·02	16·2	3·98	15·8	...	...
130	4·13	17·0	3·94	15·5	3·90	15·2	...	...
135	4·07	16·5	3·87	15·0	3·83	14·6	...	...
140	4·01	16·0	3·80	14·4	3·76	14·1	...	...
145	3·94	15·5	3·73	13·9	3·69	13·6	...	...
150	3·87	15·0	3·67	13·5	3·63	13·2	...	...
155	3·81	14·5	3·61	13·0	3·57	12·7	...	...
160	3·75	14·0	3·55	12·6	3·51	12·3	...	...
	$^*F_1G_1$		$^*H_1$		$^*r\ G_1$		$^*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{9}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	19·60	384·1	18·61	346·3	17·56	308·5
15	20·23	409·3	19·60	384·1	16·06	258·0	15·26	232·8	14·41	207·6
20	17·56	308·5	17·01	289·5	13·96	195·0	13·27	176·1	12·54	157·2
25	15·74	248·0	15·26	232·8	12·54	157·2	11·92	142·1	11·27	127·0
30	14·41	207·6	13·96	195·0	11·49	132·0	10·92	119·4	10·33	106·8
35	13·37	178·8	12·96	168·0	10·67	114·0	10·16	103·2	9·61	92·4
40	12·54	157·2	12·15	147·7	10·02	100·5	9·54	91·0	9·03	81·6
45	11·85	140·4	11·49	132·0	9·48	90·0	9·03	81·6	8·55	73·2
50	11·27	127·0	10·92	119·4	9·03	81·6	8·60	74·0	8·15	66·5
55	10·77	116·0	10·44	109·1	8·64	74·7	8·23	67·8	7·81	61·0
60	10·33	106·8	10·02	100·5	8·30	69·0	7·92	62·7	7·51	56·4
65	9·95	99·0	9·65	93·2	8·01	64·1	7·64	58·3	7·24	52·5
70	9·61	92·4	9·32	87·0	7·74	60·0	7·39	54·6	7·01	49·2
75	9·31	86·6	9·03	81·6	7·51	56·4	7·16	51·3	6·80	46·3
80	9·03	81·6	...	...	7·29	53·2	6·96	48·5	6·62	43·8
85	...	...	...	...	7·10	50·4	6·78	46·0	6·44	41·5
90	...	...	...	...	6·93	48·0	6·62	43·8	6·29	39·6
95	...	...	...	...	6·76	45·8	6·46	41·8	6·15	37·8
100	...	...	...	...	6·62	43·8	6·32	40·0	5·98	35·7
105	...	...	...	...	6·48	42·0	6·19	38·4	5·81	33·7
110	...	...	...	...	6·35	40·3	6·06	36·7	5·65	32·0
115	...	...	...	...	6·23	38·8	5·90	34·8	5·51	30·4
120	...	...	...	...	6·12	37·5	5·75	33·1	5·39	29·0
125	...	...	...	...	5·98	35·7	5·62	31·6	5·27	27·8
130	...	...	...	...	5·84	34·1	5·50	30·2	5·16	26·6
135	...	...	...	...	5·71	32·6	5·39	29·0	5·06	25·6
140	...	...	...	...	5·60	31·3	5·28	27·9	4·97	24·7
145	...	...	...	...	5·49	30·1	5·18	26·9	4·88	23·8
150	...	...	...	...	5·39	29·0	5·09	25·9	4·80	23·0
155	...	...	...	...	5·29	28·0	5·01	25·1	4·72	22·3
160	...	...	...	...	5·20	27·1	4·93	24·3	4·65	21·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE NO. 82 *continued.*

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{9}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*$r\ G_1$		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	20·35	414·3	20·13	405·3	15·67	245·5
10	15·26	232·8	14·49	210·1	14·34	205·6	11·21	125·7
15	12·54	157·2	11·92	142·1	11·79	139·0	9·26	85·8
20	10·92	119·4	10·39	108·0	10·28	105·8	8·11	65·8
25	9·83	96·7	9·36	87·6	9·26	85·8	7·34	53·9
30	9·03	81·6	8·60	74·0	8·51	72·5	6·77	45·9
35	8·41	70·8	8·02	64·3	7·94	63·0	6·34	40·2
40	7·92	62·7	7·55	57·0	7·47	55·9	5·94	35·3
45	7·51	56·4	7·16	51·3	7·09	50·3	5·55	30·8
50	7·16	51·3	6·84	46·8	6·77	45·9	5·24	27·5
55	6·87	47·2	6·56	43·1	6·50	42·3	4·99	24·9
60	6·62	43·8	6·32	40·0	6·26	39·2	4·78	22·8
65	6·39	40·9	6·11	37·3	6·03	36·4	4·58	21·0
70	6·19	38·4	5·85	34·2	5·77	33·3	4·44	19·7
75	5·98	35·7	5·62	31·6	5·55	30·8	4·31	18·6
80	5·75	33·1	5·42	29·4	5·36	28·7	4·19	17·6
85	5·56	30·9	5·25	27·5	5·19	26·9	4·09	16·7
90	5·39	29·0	5·09	25·9	5·03	25·3	4·00	16·0
95	5·23	27·4	4·95	24·5	4·90	24·0	3·89	15·1
100	5·09	25·9	4·83	23·3	4·78	22·8	3·79	14·3
105	4·97	24·7	4·71	22·2	4·66	21·7	3·70	13·6
110	4·85	23·5	4·61	21·3	4·56	20·8	3·61	13·0
115	4·75	22·5	4·52	20·4	4·47	20·0	3·53	12·5
120	4·65	21·6	4·43	19·6	4·39	19·2	...	...
125	4·56	20·8	4·35	18·9	4·31	18·6	...	...
130	4·48	20·1	4·28	18·3	4·24	17·9	...	...
135	4·41	19·4	4·21	17·7	4·17	17·4	...	...
140	4·34	18·8	4·15	17·2	4·11	16·9	...	...
145	4·27	18·2	4·09	16·7	4·05	16·4	...	...
150	4·21	17·7	4·03	16·3	4·00	16·0	...	...
155	4·15	17·2	3·97	15·8	3·93	15·4	...	...
160	4·10	16·8	3·91	15·3	3·87	14·9	...	...
	*F_1G_1		*H_1		*$r\ G_1$		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{5}{16}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	20·27	411·0	19·13	366·0
15	...	...	...	...	17·49	306·0	16·61	276·0	15·68	246·0
20	19·13	366·0	18·53	343·5	15·19	231·0	14·44	208·5	13·63	186·0
25	17·13	293·5	16·61	276·0	13·63	186·0	12·96	168·0	12·24	150·0
30	15·68	246·0	15·19	231·0	12·49	156·0	11·87	141·0	11·22	126·0
35	14·55	211·7	14·10	198·8	11·60	134·5	11·03	121·7	10·43	108·8
40	13·63	186·0	13·22	174·7	10·88	118·5	10·35	107·2	9·79	96·0
45	12·88	166·0	12·49	156·0	10·29	106·0	9·79	96·0	9·27	86·0
50	12·24	150·0	11·87	141·0	9·79	96·0	9·32	87·0	8·83	78·0
55	11·70	136·9	11·34	128·7	9·37	87·8	8·92	79·6	8·45	71·4
60	11·22	126·0	10·88	118·5	9·00	81·0	8·57	73·5	8·12	66·0
65	10·80	116·7	10·48	109·8	8·67	75·2	8·26	68·3	7·83	61·3
70	10·43	108·8	10·12	102·4	8·38	70·2	7·99	63·8	7·57	57·4
75	10·10	102·0	9·79	96·0	8·12	66·0	7·74	60·0	7·34	54·0
80	9·79	96·0	9·50	90·3	7·89	62·2	7·52	56·6	7·14	51·0
85	9·52	90·7	9·24	85·4	7·67	58·9	7·32	53·6	6·95	48·3
90	9·27	86·0	9·00	81·0	7·48	56·0	7·14	51·0	6·78	46·0
95	9·04	81·7	...	...	7·30	53·3	6·97	48·6	6·62	43·8
100	...	...	...	...	7·14	51·0	6·82	46·5	6·48	42·0
105	...	...	...	...	6·99	48·8	6·67	44·5	6·34	40·2
110	...	...	...	...	6·84	46·9	6·54	42·8	6·22	38·7
115	...	...	...	...	6·71	45·1	6·42	41·2	6·10	37·2
120	...	...	...	...	6·59	43·5	6·30	39·7	5·95	35·4
125	...	...	...	...	6·48	42·0	6·19	38·4	5·81	33·7
130	...	...	...	...	6·37	40·6	6·08	37·0	5·68	32·2
135	...	...	...	...	6·27	39·3	5·95	35·4	5·56	30·9
140	...	...	...	...	6·17	38·1	5·82	33·9	5·45	29·7
145	...	...	...	...	6·07	36·8	5·70	32·5	5·34	28·5
150	...	...	...	...	5·95	35·4	5·60	31·3	5·25	27·5
155	...	...	...	...	5·83	34·0	5·49	30·2	5·16	26·6
160	...	...	...	...	5·73	32·8	5·40	29·1	5·07	25·7
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Table No. 83 *continued.*

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{5}{16}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	..	...	17·06	291·1
10	16·61	276·0	15·78	249·0	15·60	243·6	12·18	148·5
15	13·63	186·0	12·96	168·0	12·82	164·4	10·05	101·0
20	11·87	141·0	11·29	127·5	11·17	124·8	8·79	77·2
25	10·67	114·0	10·15	103·2	10·05	101·0	7·93	63·0
30	9·79	96·0	9·32	87·0	9·23	85·2	7·31	53.5
35	9·11	83·1	8·68	75·4	8·59	73·8	6·83	46·7
40	8·57	73·5	8·17	66·7	8·08	65·4	6·45	41·6
45	8·12	66·0	7·74	60·0	7·66	58·8	6·13	37·6
50	7·74	60·0	7·39	54·6	7·31	53·5	5·77	33·3
55	7·42	55·0	7·08	50·1	7·01	49·2	5·47	29·9
60	7·14	51·0	6·82	46·5	6·75	45·6	5·22	27·2
65	6·89	47·5	6·58	43·3	6·52	42·5	5·00	25·0
70	6·67	44·5	6·38	40·7	6·32	39·9	4·82	23·2
75	6·48	42·0	6·19	38·4	6·13	37·6	4·66	21·7
80	6·30	39·7	5·99	35·9	5·91	34·9	4·53	20·5
85	6·14	37·7	5·78	33·4	5·71	32·6	4·40	19·4
90	5·95	35·4	5·60	31·3	5·53	30·5	4·29	18·4
95	5·76	33·2	5·43	29·5	5·36	28·8	4·20	17·6
100	5·60	31·3	5·28	27·9	5·22	27·2	4·11	16·9
105	5·45	29·7	5·15	26·5	5·09	25·9	4·03	16·2
110	5·31	28·2	5·02	25·2	4·97	24·7	3·94	15·5
115	5·19	26·9	4·91	24·1	4·86	23·6	3·85	14·8
120	5·07	25·7	4·81	23·1	4·76	22·6	3·77	14·2
125	4·97	24·7	4·71	22·2	4·66	21·7	3·70	13·6
130	4·87	23·7	4·63	21·4	4·58	20·9	3·62	13·1
135	4·78	22·8	4·55	20·7	4·50	20·2	3·56	12·6
140	4·70	22·0	4·47	20·0	4·43	19·6	...	...
145	4·62	21·3	4·40	19·4	4·36	19·0	...	...
150	4·55	20·7	4·34	18·8	4·29	18·4	...	...
155	4·48	20·0	4·28	18·3	4·06	16·4	...	...
160	4·41	19·5	4·22	17·8	4·01	16·0	...	...
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{11}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		E^*_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	20·70	428·5
15	...	...	...	...	18·92	358·0	17·96	322·8	16·96	287·6
20	20·70	428·5	20·05	402·0	16·43	270·0	15·61	243·6	14·74	217·2
25	18·54	344·0	17·96	322·8	14·74	217·2	14·00	196·0	13·22	175·0
30	16·96	287·6	16·43	270·0	13·49	182·0	12·82	164·4	12·11	146·8
35	15·73	247·4	15·24	232·3	12·52	156·8	11·90	141·8	11·25	126·7
40	14·74	217·2	14·28	204·0	11·74	138·0	11·17	124·8	10·56	111·6
45	13·92	193·7	13·49	182·0	11·10	123·3	10·56	111·6	9·99	99·8
50	13·22	175·0	12·82	164·4	10·56	111·6	10·05	101·0	9·51	90·5
55	12·63	159·6	12·24	150·0	10·10	102·0	9·61	92·4	9·10	82·8
60	12·11	146·8	11·74	138·0	9·69	94·0	9·23	85·2	8·74	76·4
65	11·66	136·0	11·30	127·8	9·34	87·2	8·89	79·1	8·42	71·0
70	11·25	126·7	10·91	119·1	9·02	81·4	8·59	73·9	8·14	66·3
75	10·89	118·6	10·56	111·6	8·74	76·4	8·33	69·3	7·89	62·3
80	10·56	111·6	10·24	105·0	8·48	72·0	8·08	65·4	7·66	58·8
85	10·26	105·4	9·96	99·1	8·25	68·1	7·86	61·9	7·46	55·7
90	9·99	99·8	9·69	94·0	8·04	64·6	7·66	58·8	7·27	52·9
95	9·74	94·9	9·45	89·3	7·84	61·5	7·48	56·0	7·10	50·4
100	9·51	90·5	9·23	85·2	7·66	58·8	7·31	53·5	6·94	48·2
105	9·30	86·4	9·02	81·4	7·50	56·2	7·16	51·2	6·80	46·2
110	9·10	82·8	...	...	7·35	54·0	7·01	49·2	6·66	44·4
115	...	...	...	...	7·20	51·9	6·88	47·3	6·53	42·7
120	...	...	...	...	7·07	50·0	6·75	45·6	6·42	41·2
125	...	...	...	...	6·94	48·2	6·63	44·0	6·30	39·8
130	...	...	...	...	6·82	46·6	6·52	42·5	6·20	38·5
135	...	...	...	...	6·71	45·1	6·42	41·2	6·10	37·2
140	...	...	...	...	6·61	43·7	6·32	39·9	5·97	35·6
145	...	...	...	...	6·51	42·4	6·22	38·7	5·85	34·2
150	...	...	...	...	6·42	41·2	6·13	37·6	5·73	32·9
155	...	...	...	...	6·33	40·0	6·02	36·3	5·63	31·6
160	...	...	...	...	6·24	39·0	5·91	34·9	5·53	30·5
	*A_1		*B_1		*C_1		*D_1		E^*_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{11}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	18·45	340·6
10	17·96	322·8	17·06	291·1	16·87	284·8	13·16	173·3
15	14·74	217·2	14·00	196·0	13·85	191·9	10·84	117·5
20	12·82	164·4	12·19	148·5	12 06	145·4	9·46	89·6
25	11·52	132·7	10·95	120·0	10·84	117·5	8·54	72·9
30	10·56	111·6	10·05	101·0	9·94	98·9	7·86	61·7
35	9·82	96·5	9·35	87·4	9·25	85·6	7·33	53·8
40	9·23	85·2	8·79	77·2	8·70	75·7	6·91	47·8
45	8·74	76·4	8·33	69·3	8·24	67·9	6·57	43·1
50	8·33	69·3	7·94	63·0	7·86	61·7	6·28	39·4
55	7·97	63·6	7·60	57·8	7·53	56·7	6·00	36·0
60	7·66	58·8	7·31	53·5	7·24	52·4	5·70	32·5
65	7·40	54·7	7·06	49·8	6·99	48·9	5·45	29·7
70	7·16	51·2	6·83	46·7	6·77	45·8	5·23	27·4
75	6·94	48·2	6·63	44·0	6·57	43·1	5·05	25·5
80	6·75	45·6	6·45	41·6	6·39	40·8	4·89	23·9
85	6·57	43·2	6·28	39·5	6·23	38·8	4·74	22·5
90	6·42	41·2	6·13	37·6	6·06	36·7	4·61	21·3
95	6·27	39·3	5·95	35·4	5·87	34·5	4·50	20·2
100	6·14	37·6	5·77	33·3	5·70	32·5	4·40	19·3
105	5·97	35·6	5·61	31·5	5·54	30·7	4·30	18·5
110	5·81	33·7	5·47	29·9	5·40	29·2	4·22	17·8
115	5·66	32·0	5·34	28·5	5·27	27·8	4·14	17·2
120	5·53	30·5	5·22	27·2	5·16	26·6	4·07	16·6
125	5·40	29·2	5·11	26·1	5·05	25·5	4·01	16·0
130	5·29	28·0	5·01	25·0	4·95	24·5	3·93	15·4
135	5·18	26·9	4·91	24·1	4·86	23·6	3·85	14·8
140	5·09	25·9	4·82	23·2	4·77	22·7	3·78	14·3
145	5·00	25·0	4·74	22·5	4·69	22·0	3·72	13·8
150	4·91	24·1	4·66	21·7	4·61	21·3	3·65	13·3
155	4·83	23·3	4·59	21·1	4·54	20·6	3·59	12·9
160	4·76	22·6	4·53	20·5	4·48	20·0	3·54	12·5
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{3}{8}$ inch thick.

Pressure per sq. in	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	20·35	414·3	19·32	373·5	18·24	332·6
20	...	...	...	...	17·67	312·2	16·78	281·6	15·84	251·0
25	19·95	398·0	19·32	373·5	15·84	251·0	15·05	226·5	14·21	202·0
30	18·24	332·6	17·67	312·2	14·49	210·1	13·77	189·7	13·01	169·3
35	16·91	286·0	16·38	268·5	13·45	181·0	12·78	163·5	12·08	146·0
40	15·84	251·0	15·35	235·6	12·61	159·1	11·99	143·8	11·33	128·5
45	14·96	223·7	14·49	210·1	11·92	142·1	11·33	128·5	10·71	114·8
50	14·21	202·0	13·77	189·7	11·33	128·5	10·78	116·2	10·19	104·0
55	13·57	184·1	13·15	173·0	10·83	117·3	10·30	106·2	9·75	95·0
60	13·01	169·3	12·61	159·1	10·39	108·0	9·89	97·8	9·36	87·6
65	12·52	156·7	12·13	147·3	10·01	100·2	9·53	90·8	9·02	81·3
70	12·08	146·0	11·71	137·2	9·67	93·5	9·20	84·7	8·71	76·0
75	11·69	136·6	11·33	128·5	9·36	87·6	8·91	79·5	8·44	71·3
80	11·33	128·5	10·99	120·8	9·08	82·5	8·65	74·9	8·20	67·2
85	11·01	121·2	10·68	114·0	8·83	78·0	8·41	70·8	7·97	63·6
90	10·71	114·8	10·39	108·0	8·60	74·0	8·20	67·2	7·77	60·4
95	10·44	109·1	10·13	102·7	8·39	70·4	8·00	64·0	7·58	57·5
100	10·19	104·0	9·89	97·8	8·20	67·2	7·81	61·1	7·41	55·0
105	9·96	99·3	9·67	93·5	8·02	64·3	7·64	58·5	7·25	52·6
110	9·75	95·0	9·46	89·5	7·85	61·6	7·49	56·1	7·11	50·5
115	9·55	91·2	9·26	85·8	7·69	59·2	7·34	53·9	6·97	48·6
120	9·36	87·6	9·08	82·5	7·55	57·0	7·20	51·9	6·84	46·8
125	9·18	84·4	...	...	7·41	55·0	7·07	50·1	6·72	45·2
130	9·02	81·3	...	...	7·28	53·1	6·95	48·4	6·61	43·6
135	...	...	...	...	7·16	51·3	6·84	46·8	6·50	42·2
140	...	...	...	...	7·05	49·7	6·73	45·3	6·40	41·0
145	...	...	...	...	6·94	48·2	6·63	44·0	6·30	39·7
150	...	...	...	...	6·84	46·8	6·53	42·7	6·21	38·6
155	...	...	...	...	6·74	45·5	6·44	41·5	6·13	37·6
160	...	...	...	...	6·65	44·2	6·36	40·4	6·02	36·2
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 85 *continued.*

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{3}{8}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	19·32	373·5	18·35	336·7	18·15	329·4	14·14	200·0
15	15·84	251·0	15·05	226·5	14·88	221·6	11·63	135·3
20	13·77	189·7	13·09	171·3	12·95	167·7	10·15	103·0
25	12·37	153·0	11·76	138·3	11·63	135·3	9·14	83·6
30	11·33	128·5	10·78	116·2	10·66	113·8	8·40	70·6
35	10·53	111·0	10·02	100·5	9·92	98·4	7·83	61·4
40	9·89	97·8	9·41	88·6	9·32	86·8	7·38	54·5
45	9·36	87·6	8·91	79·5	8·82	77·8	7·00	49·0
50	3·91	79·5	8·49	72·1	8·40	70·6	6·69	44·8
55	8·53	72·8	8·13	66·1	8·05	64·8	6·42	41·2
60	8·20	67·2	7·81	61·1	7·74	59·9	6·19	38·3
65	7·90	62·5	7·54	56·8	7·46	55·7	5·93	35·1
70	7·64	58·5	7·29	53·2	7·22	52·2	5·68	32·3
75	7·41	55·0	7·07	50·1	7·00	49·0	5·46	29·9
80	7·20	51·9	6·88	47·3	6·81	46·4	5·28	27·8
85	7·01	49·2	6·70	44·9	6·63	44·0	5·11	26·1
90	6·84	46·8	6·53	42·7	6·47	41·9	4·96	24·6
95	6·68	44·6	6·38	40·8	6·32	40·0	4·83	23·3
100	6·53	42·7	6·25	39·0	6·19	38·3	4·71	22·2
105	6·40	41·0	6·12	37·5	6·04	36·5	4·60	21·2
110	6·27	39·4	5·95	35·4	5·88	34·5	4·50	20·3
115	6·16	37·9	5·80	33·7	5·73	32·8	4·41	19·5
120	6·02	36·2	5·66	32·0	5·59	31·2	4·33	18·8
125	5·88	34·5	5·53	30·6	5·46	29·9	4·26	18·1
130	5·74	33·0	5·41	29·3	5·35	28·6	4·19	17·5
135	5·62	31·6	5·30	28·1	5·24	27·5	4·12	17·0
140	5·51	30·3	5·20	27·1	5·14	26·4	4·06	16·5
145	5·40	29·2	5·11	26·1	5·05	25·5	4·01	16·0
150	5·30	28·1	5·02	25·2	4·96	24·6	3·94	15·5
155	5·21	27·2	4·94	24·3	4·88	23·8	3·87	15·0
160	5·13	26·3	4·86	23·6	4·80	23·1	3·81	14·5
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{13}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	20·68	427·8	19·52	381·0
20	...	...	...	...	18·91	357·5	17·95	322·4	16·94	287·2
25	...	...	20·68	427·8	16·94	287·2	16·09	259·1	15·19	231·0
30	19·52	381·0	18·91	357·5	15·50	240·3	14·72	216·9	13·91	193·5
35	18·09	327·4	17·53	307·3	14·38	206·8	13·66	186·8	12·91	166·7
40	16·94	287·2	16·42	269·6	13·48	181·7	12·81	164·2	12·10	146·6
45	16·00	256·0	15·50	240·3	12·73	162·2	12·10	146·6	11·44	131·0
50	15·19	231·0	14·72	216·9	12·10	146·6	11·51	132·5	10·88	118·5
55	14·51	210·5	14·06	197·7	11·56	133·8	11·00	121·0	10·40	108·2
60	13·91	193·5	13·48	181·7	11·09	123·1	10·55	111·4	9·98	99·7
65	13·38	179·0	12·97	168·2	10·68	114·1	10·16	103·3	9·62	92·5
70	12·91	166·7	12·51	156·6	10·31	106·4	9·81	96·4	9·29	86·3
75	12·49	156·0	12·10	146·6	9·98	99·7	9·50	90·3	9·00	81·0
80	12·10	146·6	11·74	137·8	9·69	93·8	9·22	85·1	8·73	76·3
85	11·76	138·3	11·40	130·0	9·42	88·7	8·97	80·4	8·49	72·1
90	11·44	131·0	11·09	123·1	9·17	84·1	8·73	76·3	8·27	68·5
95	11·15	124·4	10·81	117·0	8·94	80·0	8·52	72·6	8·07	65·2
100	10·88	118·5	10·55	111·4	8·73	76·3	8·32	69·2	7·89	62·2
105	10·63	113·1	10·31	106·4	8·54	72·9	8·14	66·2	7·71	59·5
110	10·40	108·2	10·09	101·8	8·36	69·9	7·97	63·5	7·55	57·1
115	10·19	103·8	9·88	97·7	8·19	67·1	7·81	61·0	7·41	54·9
120	9·98	99·7	9·69	93·8	8·03	64·5	7·66	58·7	7·27	52·8
125	9·79	96·0	9·50	90·3	7·89	62·2	7·52	56·6	7·14	51·0
130	9·62	92·5	9·33	87·1	7·75	60·0	7·39	54·6	7·02	49·2
135	9·45	89·3	9·17	84·1	7·62	58·0	7·27	52·8	6·90	47·6
140	9·29	86·3	9·01	81·3	7·49	56·2	7·15	51·2	6·79	46·1
145	9·14	83·5	...	...	7·38	54·4	7·04	49·6	6·69	44·7
150	9·00	81·0	...	...	7·27	52·8	6·94	48·1	6·59	43·5
155	...	...	...	...	7·16	51·3	6·84	46·8	6·50	42·2
160	...	...	...	...	7·06	49·9	6·75	45·5	6·41	41·1
	*A_1		*B_1		*C_1		*D_1		E^*_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 86 *continued.*

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{13}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	20·68	427·8	19·63	385·6	19·42	377·2	15·12	228·7
15	16·94	287·2	16·09	259·1	15·92	253·5	12·43	154·5
20	14·72	216·9	13·99	195·8	13·84	191·6	10·83	117·3
25	13·22	174·7	12·56	157·8	12·43	154·5	9·75	95·1
30	12·10	146·6	11·51	132·5	11·39	129·7	8·95	80·2
35	11·24	126·5	10·70	114·4	10·58	112·0	8·34	69·6
40	10·55	111·4	10·04	100·9	9·94	98·8	7·85	61·6
45	9·98	99·7	9·50	90·3	9·40	88·5	7·45	55·5
50	9·50	90·3	9·05	81·9	8·95	80·2	7·11	50·5
55	9·09	82·7	8·66	75·0	8·57	73·5	6·82	46·5
60	8·73	76·3	8·32	69·2	8·23	67·8	6·56	43·1
65	8·42	70·9	8·02	64·4	7·94	63·1	6·34	40·2
70	8·14	66·2	7·76	60·2	7·68	59·0	6·15	37·8
75	7·89	62·2	7·52	56·6	7·45	55·5	5·91	34·9
80	7·66	58·7	7·31	53·4	7·24	52·4	5·69	32·4
85	7·45	55·6	7·11	50·6	7·04	49·6	5·50	30·3
90	7·27	52·8	6·94	48·1	6·87	47·2	5·33	28·4
95	7·10	50·4	6·78	45·9	6·71	45·0	5·18	26·8
100	6·94	48·1	6·63	43·9	6·56	43·1	5·04	25·4
105	6·79	46·1	6·49	42·1	6·43	41·3	4·92	24·2
110	6·66	44·3	6·36	40·5	6·30	39·7	4·81	23·1
115	6·53	42·6	6·24	39·0	6·18	38·2	4·71	22·1
120	6·41	41·1	6·13	37·6	6·06	36·7	4·61	21·3
125	6·30	39·7	5·99	35·9	5·91	34·9	4·53	20·5
130	6·20	38·4	5·85	34·3	5·78	33·4	4·45	19·7
135	6·09	37·1	5·73	32·8	5·65	32·0	4·37	19·1
140	5·96	35·5	5·61	31·5	5·54	30·7	4·30	18·5
145	5·84	34·1	5·50	30·3	5·43	29·5	4·24	17·9
150	5·73	32·8	5·40	29·1	5·33	28·4	4·18	17·4
155	5·62	31·6	5·30	28·1	5·24	27·4	4·12	17·0
160	5·52	30·5	5·21	27·2	5·15	26·5	4·07	16·5
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{7}{16}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	20·80	432·6
20	...	...	...	...	20·15	406·0	19·13	366·0	18·05	326·0
25	...	...	...	...	18·05	326·0	17·14	294·0	16·18	262·0
30	20·80	432·6	20·15	406·0	16·51	272·6	15·68	246·0	14·81	219·3
35	19·28	371·7	18·67	348·8	15·31	234·5	14·55	211·7	13·74	188·8
40	18·05	326·0	17·49	306·0	14·35	206·0	13·63	186·0	12·88	166·0
45	17·04	290·4	16·51	272·6	13·55	183·7	12·88	166·0	12·17	148·2
50	16·18	262·0	15·68	246·0	12·88	166·0	12·24	150·0	11·57	134·0
55	15·45	238·7	14·97	224·1	12·30	151·4	11·70	136·9	11·06	122·3
60	14·81	219·3	14·35	206·0	11·80	139·3	11·22	126·0	10·61	112·6
65	14·24	202·9	13·80	190·6	11·36	129·0	10·80	116·7	10·22	104·4
70	13·74	188·8	13·32	177·4	10·96	120·2	10·43	108·8	9·87	97·4
75	13·29	176·6	12·88	166·0	10·61	112·6	10·10	102·0	9·55	91·3
80	12·88	166·0	12·49	156·0	10·29	106·0	9·79	96·0	9·27	86·0
85	12·51	156·5	12·13	147·1	10·00	100·0	9·52	90·7	9·01	81·2
90	12·17	148·2	11·80	139·3	9·74	94·8	9·27	86·0	8·78	77·1
95	11·86	140·7	11·50	132·3	9·49	90·2	9·04	81·7	8·56	73·3
100	11·57	134·0	11·22	126·0	9·27	86·0	8·83	78·0	8·36	70·0
105	11·31	127·9	10·96	120·2	9·06	82·1	8·63	74·5	8·18	66·9
110	11·06	122·3	10·72	115·0	8·87	78·7	8·45	71·4	8·01	64·1
115	10·83	117·3	10·50	110·3	8·69	75·5	8·28	68·6	7·85	61·6
120	10·61	112·6	10·29	106·0	8·52	72·6	8·12	66·0	7·70	59·3
125	10·41	108·4	10·10	102·0	8·36	70·0	7·97	63·6	7·56	57·2
130	10·22	104·4	9·91	98·3	8·21	67·5	7·83	61·3	7·43	55·2
135	10·04	100·8	9·74	94·8	8·07	65·2	7·70	59·3	7·30	53·4
140	9·87	97·4	9·57	91·7	7·94	63·1	7·57	57·4	7·19	51·7
145	9·71	94·2	9·42	88·7	7·82	61·1	7·46	55·6	7·08	50·1
150	9·55	91·3	9·27	86·0	7·70	59·3	7·34	54·0	6·97	48·6
155	9·41	88·5	9·13	83·4	7·59	57·6	7·24	52·4	6·87	47·2
160	9·27	86·0	9·00	81·0	7·48	56·0	7·14	51·0	6·78	46·0
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{7}{16}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	20·92	438·0	20·69	428·4	16·10	259·4
15	18·05	326·0	17·14	294·0	16·95	287·6	13·22	174·9
20	15·68	246·0	14·90	222·0	14·73	217·2	11·52	132·7
25	14·07	198·0	13·37	178·8	13·22	174·9	10·36	107·3
30	12·88	166·0	12·24	150·0	12·11	146·8	9·51	90·4
35	11·96	143·1	11·37	129·4	11·25	126·6	8·85	78·4
40	11·22	126·0	10·67	114·0	10·56	111·6	8·32	69·3
45	10·61	112·6	10·10	102·0	9·99	99·8	7·89	62·3
50	10·10	102·0	9·61	92·4	9·51	90·4	7·53	56·6
55	9·65	93·2	9·19	84·5	9·10	82·8	7·21	52·0
60	9·27	86·0	8·83	78·0	8·74	76·4	6·94	48·2
65	8·93	79·8	8·51	72·4	8·42	70·9	6·70	44·9
70	8·63	74·5	8·22	67·7	8·14	66·3	6·49	42·2
75	8·36	70·0	7·97	63·6	7·89	62·3	6·30	39·7
80	8·12	66·0	7·74	60·0	7·66	58·8	6·13	37·6
85	7·90	62·4	7·53	56·8	7·46	55·6	5·92	35·1
90	7·70	59·3	7·34	54·0	7·27	52·9	5·73	32·8
95	7·51	56·5	7·17	51·4	7·10	50·4	5·56	30·9
100	7·34	54·0	7·01	49·2	6·94	48·2	5·40	29·2
105	7·19	51·7	6·86	47·1	6·80	46·2	5·26	27·7
110	7·04	49·6	6·72	45·2	6·66	44·4	5·13	26·3
115	6·91	47·7	6·60	43·5	6·53	42·7	5·02	25·2
120	6·78	46·0	6·48	42·0	6·41	41·2	4·91	24·1
125	6·66	44·4	6·36	40·5	6·30	39·7	4·81	23·1
130	6·55	42·9	6·26	39·2	6·20	38·4	4·72	22·3
135	6·44	41·5	6·16	38·0	6·10	37·2	4·64	21·5
140	6·34	40·2	6·05	36·6	5·97	35·6	4·56	20·8
145	6·25	39·1	5·92	35·1	5·84	34·2	4·49	20·1
150	6·16	38·0	5·81	33·7	5·73	32·8	4·42	19·5
155	6·06	36·7	5·70	32·5	5·63	31·6	4·35	18·9
160	5·95	35·4	5·60	31·3	5·53	30·5	4·29	18·4
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{15}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	20·30	412·4	19·16	357·2
25	...	...	...	...	19·16	367·2	18·19	331·1	17·17	295·0
30	...	...	...	...	17·52	307·0	16·64	276·9	15·71	246·8
35	20·46	418·8	19·82	393·0	16·25	264·0	15·43	238·2	14·57	212·4
40	19·16	367·2	18·56	344·6	15·22	231·7	14·46	209·2	13·66	186·6
45	18·08	327·1	17·52	307·0	14·37	206·6	13·66	186·6	12·90	166·5
50	17·17	295·0	16·64	276·9	13·66	186·6	12·98	168·5	12·26	150·5
55	16·39	268·7	15·88	252·3	13·04	170·2	12·40	153·7	11·72	137·3
60	15·71	246·8	15·22	231·7	12·51	156·5	11·89	141·4	11·24	126·4
65	15·11	228·3	14·64	214·4	12·04	144·9	11·44	131·0	10·82	117·1
70	14·57	212·4	14·12	199·5	11·62	135·0	11·05	122·1	10·45	109·2
75	14·09	198·6	13·66	186·6	11·24	126·4	10·69	114·3	10·11	102·3
80	13·66	186·6	13·24	175·3	10·90	118·8	10·37	107·6	9·81	96·3
85	13·26	176·0	12·86	165·3	10·59	112·2	10·08	101·6	9·54	91·0
90	12·90	166·5	12·51	156·5	10·31	106·3	9·81	96·3	9·28	86·2
95	12·57	158·1	12·19	148·5	10·05	101·0	9·56	91·5	9·05	82·0
100	12·26	150·5	11·89	141·4	9·84	96·9	9·34	87·2	8·84	78·2
105	11·98	143·6	11·62	135·0	9·59	92·0	9·13	83·4	8·65	74·8
110	11·72	137·3	11·36	129·1	9·38	88·1	8·93	79·8	8·46	71·6
115	11·47	131·6	11·12	123·7	9·19	84·5	8·75	76·6	8·29	68·8
120	11·24	126·4	10·90	118·8	9·01	81·2	8·58	73·7	8·13	66·2
125	11·02	121·6	10·69	114·3	8·84	78·2	8·42	71·0	7·98	63·8
130	10·82	117·1	10·49	110·2	8·68	75·4	8·27	68·5	7·84	61·5
135	10·63	113·0	10·31	106·3	8·53	72·8	8·13	66·2	7·71	59·5
140	10·45	109·2	10·13	102·6	8·39	70·5	8·00	64·0	7·59	57·6
145	10·27	105·6	9·97	99·4	8·26	68·2	7·87	62·0	7·47	55·8
150	10·11	102·3	9·81	96·3	8·13	66·2	7·75	60·1	7·36	54·1
155	9·96	99·2	9·66	93·3	8·01	64·2	7·64	58·4	7·25	52·6
160	9·81	96·3	9·52	90·6	7·90	62·4	7·53	56·8	7·15	51·1
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 88 *continued.*

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{15}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	17·09	292·1
15	19·16	367·2	18·19	331·1	17·99	323·9	14·02	196·7
20	16·64	276·9	15·80	249·8	15·63	244·4	12·20	149·0
25	14·92	222·7	14·18	201·0	14·02	196·7	10·97	120·4
30	13·66	186·6	12·98	168·5	12·84	164·9	10·06	101·3
35	12·68	160·8	12·05	145·3	11·92	142·2	9·36	87·7
40	11·89	141·4	11·31	127·9	11·19	125·2	8·80	77·5
45	11·24	126·4	10·69	114·3	10·58	111·9	8·34	69·5
50	10·69	114·3	10·17	103·5	10·06	101·3	7·95	63·2
55	10·22	104·5	9·73	94·6	9·62	92·7	7·61	58·0
60	9·81	96·3	9·34	87·2	9·24	85·4	7·32	53·6
65	9·45	89·3	9·00	81·0	8·90	79·3	7·07	50·0
70	9·13	83·4	8·69	75·6	8·61	74·1	6·84	46·8
75	8·84	78·2	8·42	71·0	8·34	69·5	6·64	44·1
80	8·58	73·7	8·18	66·9	8·10	65·6	6·46	41·7
85	8·35	69·7	7·96	63·3	7·88	62·1	6·29	39·6
90	8·13	66·2	7·75	60·1	7·68	58·9	6·14	37·7
95	7·94	63·0	7·57	57·3	7·49	56·1	5·96	35·5
100	7·75	60·1	7·40	54·7	7·32	53·6	5·78	33·4
105	7·59	57·6	7·24	52·4	7·17	51·4	5·62	31·6
110	7·43	55·2	7·09	50·3	7·02	49·3	5·48	30·0
115	7·28	53·1	6·95	48·4	6·89	47·4	5·35	28·6
120	7·15	51·1	6·83	46·6	6·76	45·7	5·23	27·3
125	7·02	49·3	6·71	45·0	6·64	44·1	5·12	26·2
130	6·90	47·6	6·59	43·5	6·53	42·6	5·01	25·1
135	6·79	46·1	6·49	42·1	6·42	41·3	4·92	24·2
140	6·68	44·7	6·39	40·8	6·33	40·0	4·83	23·3
145	6·58	43·3	6·29	39·6	6·23	38·8	4·75	22·5
150	6·49	42·1	6·20	38·5	6·14	37·7	4·67	21·8
155	6·40	40·9	6·12	37·4	6·04	36·4	4·60	21·1
160	6·31	39·8	6·00	36·0	5·92	35·1	4·53	20·5
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate ½ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	..	...	...	...	20·27	411·0
25	...	...	...	...	20·27	411·0	19·24	370·5	18·16	330·0
30	...	...	...	...	18·53	343·5	17·60	309·7	16·61	276·0
35	...	...	20·97	439·9	17·18	295·2	16·32	266·3	15·40	237·4
40	20·27	411·0	19·63	385·6	16·09	259·1	15·29	233·8	14·44	208·5
45	19·13	366·0	18·53	343·5	15·19	231·0	14·44	208·5	13·63	186 0
50	18·16	330·0	17·60	309·7	14·44	208·5	13·72	188·2	12·96	168·0
55	17·33	300·5	16·79	282·1	13·78	190·0	13·10	171·6	12·38	153·2
60	16·61	276·0	16·09	259·1	13·22	174·7	12·56	157·8	11·87	141·0
65	15·97	255·2	15·48	239·6	12·71	161·7	12·09	146·1	11·42	130·6
70	15·40	237·4	14·93	222·9	12·27	150·6	11·67	136·1	11·03	121·7
75	14·90	222·0	14·44	208·5	11·87	141·0	11·29	127·5	10·67	114·0
80	14·44	208·5	13·99	195·8	11·51	132·5	10·95	119·9	10·35	107·2
85	14·02	196·5	13·59	184·6	11·18	125·1	10·64	113·2	10·06	101·2
90	13·63	186·0	13·22	174·7	10·88	118·5	10·35	107·2	9·79	96·0
95	13·28	176·5	12·87	165·8	10·61	112·5	10·09	101·9	9·55	91·2
100	12·96	168·0	12·56	157·8	10·35	107·2	9·85	97·1	9·32	87·0
105	12·66	160·2	12·27	150·6	10·12	102·4	9·63	92·7	9·11	83·1
110	12·38	153·2	12·00	144·0	9·90	98·0	9·42	88·8	8·92	79·6
115	12·11	146·8	11·75	138·0	9·69	94·0	9·23	85·2	8·74	76·4
120	11·87	141·0	11·51	132·5	9·50	90·3	9·05	81·9	8·57	73·5
125	11·64	135·6	11·29	127·5	9·32	87·0	8·88	78·9	8·41	70·8
130	11·42	130·6	11·08	122·8	9·15	83·8	8·72	76·0	8·26	68·3
135	11·22	126·0	10·88	118·5	9·00	81·0	8·57	73·5	8·12	66·0
140	11·03	121·7	10·70	114·4	8·85	78·3	8·43	71·0	7·99	63·8
145	10·85	117·7	10·52	110·7	8·70	75·8	8·29	68·8	7·86	61·8
150	10·67	114·0	10·35	107·2	8·57	73·5	8·17	66·7	7·74	60·0
155	10·51	110·5	10·19	103·9	8·44	71·3	8·05	64·7	7·63	58·2
160	10·35	107·2	10·04	100·9	8·32	69·2	7·93	62·9	7·52	56·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate ½ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	18·07	326·7
15	20·27	411·0	19·24	370·5	19·03	362·4	14·82	219·8
20	17·60	309·7	16·71	279·3	16·53	273·3	12·89	166·3
25	15·78	249·0	14·99	224·7	14·82	219·8	11·58	134·3
30	14·44	208·5	13·72	188·2	13·57	184·2	10·62	112·9
35	13·40	179·5	12·73	162·2	12·60	158·7	9·88	97·6
40	12·56	157·8	11·94	142·6	11·81	139·6	9·28	86·1
45	11·87	141·0	11·29	127·5	11·17	124·8	8·79	77·2
50	11·29	127·5	10·74	115·3	10·62	112·9	8·37	70·1
55	10·79	116·4	10·26	105·4	10·15	103·2	8·02	64·3
60	10·35	107·2	9·85	97·1	9·75	95·1	7·71	59·4
65	9·97	99·4	9·49	90·1	9·39	88·2	7·44	55·3
70	9·63	92·7	9·17	84·1	9·07	82·3	7·19	51·8
75	9·32	87·0	8·88	78·9	8·79	77·2	6·98	48·7
80	9·05	81·9	8·62	74·3	8·53	72·8	6·79	46·0
85	8·80	77·4	8·38	70·3	8·30	68·8	6·61	43·7
90	8·57	73·5	8·17	66·7	8·08	65·4	6·45	41·6
95	8·36	69·9	7·97	63·5	7·89	62·2	6·30	39·7
100	8·17	66·7	7·79	60·6	7·71	59·4	6·17	38·0
105	7·99	63·8	7·62	58·0	7·54	56·9	6·01	36·1
110	7·82	61·2	7·46	55·7	7·39	54·6	5·85	34·2
115	7·67	58·8	7·31	53·5	7·24	52·4	5·70	32·5
120	7·52	56·6	7·18	51·5	7·11	50·5	5·56	31·0
125	7·39	54·6	7·05	49·7	6·98	48·7	5·44	29·6
130	7·26	52·7	6·93	48·0	6·86	47·1	5·32	28·3
135	7·14	51·0	6·82	46·5	6·75	45·6	5·22	27·2
140	7·02	49·3	6·71	45·0	6·64	44·1	5·12	26·2
145	6·92	47·8	6·61	43·7	6·54	42·8	5·03	25·3
150	6·82	46·5	6·51	42·4	6·45	41·6	4·94	24·4
155	6·72	45·1	6·42	41·2	6·36	40·4	4·86	23·6
160	6·63	43·9	6·33	40·1	6·27	39·4	4·78	22·9
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{17}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	20·30	412·1	19·15	367·0
30	...	...	...	...	19·54	382·0	18·56	344·4	17·51	306·8
35	...	...	...	...	18·12	328·3	17·20	296·0	16·24	263·8
40	...	...	20·71	429·0	16·97	288·0	16·12	259·8	15·22	231·6
45	20·17	407·1	19·54	382·0	16·02	256·6	15·22	231·6	14·37	206·5
50	19·15	367·0	18·56	344·4	15·22	231·6	14·45	209·0	13·65	186·5
55	18·28	334·1	17·71	313·6	14·53	211·1	13·80	190·6	13·04	170·0
60	17·51	306·8	16·97	288·0	13·93	194·0	13·23	175·2	12·50	156·4
65	16·84	283·6	16·32	266·3	13·40	179·5	12·73	162·2	12·03	144·8
70	16·24	263·8	15·74	247·7	12·93	167·1	12·29	151·0	11·61	134·9
75	15·70	246·6	15·22	231·6	12·50	156·4	11·89	141·3	11·24	126·3
80	15·22	231·6	14·74	217·5	12·12	147·0	11·52	132·9	10·90	118·8
85	14·77	218·3	14·32	205·0	11·77	138·7	11·20	125·4	10·59	112·1
90	14·37	206·5	13·93	194·0	11·46	131·3	10·90	118·8	10·31	106·2
95	14·00	196·0	13·57	184·1	11·17	124·7	10·62	112·8	10·05	101·0
100	13·65	186·5	13·23	175·2	10·90	118·8	10·37	107·5	9·81	96·2
105	13·33	177·9	12·93	167·1	10·65	113·4	10·13	102·6	9·59	91·9
110	13·04	170·0	12·64	159·8	10·42	108·5	9·91	98·3	9·38	88·0
115	12·76	162·9	12·37	153·1	10·20	104·0	9·71	94·2	9·19	84·4
120	12·50	156·4	12·12	147·0	10·00	100·0	9·51	90·6	9·01	81·2
125	12·26	150·4	11·89	141·3	9·81	96·2	9·34	87·2	8·84	78·2
130	12·03	144·8	11·67	136·1	9·63	92·7	9·17	84·1	8·68	75·4
135	11·82	139·7	11·46	131·3	9·46	89·5	9·01	81·2	8·53	72·8
140	11·61	134·9	11·26	126·8	9·30	86·5	8·86	78·5	8·39	70·4
145	11·42	130·4	11·07	122·7	9·15	83·8	8·72	76·0	8·26	68·2
150	11·24	126·3	10·90	118·8	9·01	81·2	8·58	73·6	8·13	66·1
155	11·06	122·4	10·73	115·1	8·87	78·7	8·45	71·5	8·01	64·2
160	10·90	118·8	10·57	111·7	8·74	76·5	8·33	69·4	7·90	62·4
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{17}{32}$ inch thick.

Pressure per sq. in.	$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	19·06	363·3
15	...	...	20·30	412·1	20·07	403·1	15·62	244·2
20	18·56	344·4	17·62	310·5	17·43	303·8	13·59	184·6
25	16·63	276·7	15·80	249·6	15·62	244·2	12·20	148·9
30	15·22	231·6	14·45	209·0	14·30	204·5	11·18	125·1
35	14·12	199·3	13·41	180·0	13·27	176·1	10·39	108·1
40	13·23	175·2	12·58	158·2	12·44	154·9	9·76	95·3
45	12·50	156·4	11·89	141·3	11·76	138·3	9·24	85·4
50	11·89	141·3	11·30	127·8	11·18	125·1	8·80	77·4
55	11·36	129·0	10·80	116·7	10·69	114·3	8·42	70·9
60	10·90	118·8	10·37	107·5	10·26	105·2	8·09	65·5
65	10·49	110·1	9·98	99·7	9·88	97·6	7·81	60·9
70	10·13	102·6	9·64	93·0	9·54	91·0	7·55	57·0
75	9·81	96·2	9·34	87·2	9·24	85·4	7·32	53·6
80	9·51	90·6	9·06	82·1	8·97	80·4	7·11	50·6
85	9·25	85·6	8·81	77·6	8·72	76·0	6·93	48·0
90	9·01	81·2	8·58	73·6	8·49	72·1	6·76	45·7
95	8·79	77·2	8·37	70·1	8·28	68·7	6·60	43·6
100	8·58	73·6	8·18	66·9	8·09	65·5	6·46	41·7
105	8·39	70·4	8·00	64·0	7·92	62·7	6·32	40·0
110	8·21	67·5	7·83	61·3	7·75	60·1	6·20	38·4
115	8·05	64·8	7·68	58·9	7·60	57·7	6·07	36·9
120	7·90	62·4	7·53	56·7	7·46	55·6	5·92	35·1
125	7·75	60·1	7·39	54·7	7·32	53·6	5·78	33·4
130	7·62	58·0	7·27	52·8	7·19	51·8	5·65	32·0
135	7·49	56·1	7·15	51·1	7·08	50·1	5·53	30·6
140	7·37	54·3	7·03	49·5	6·96	48·5	5·42	29·4
145	7·25	52·6	6·93	48·0	6·86	47·0	5·32	28·3
150	7·15	51·1	6·82	46·6	6·76	45·7	5·23	27·3
155	7·04	49·6	6·73	45·3	6·66	44·4	5·14	26·4
160	6·95	48·3	6·63	44·0	6·57	43·2	5·05	25·5
	$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{9}{16}$ inch thick.

Pressure per sq.in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	20·15	406·0
30	...	...	...	...	20·55	422·6	19·52	381·0	18·42	339·3
35	...	...	...	...	19·05	363·1	18·09	327·4	17·08	291·7
40	...	...	...	...	17·84	318·5	16·94	287·2	16·00	256·0
45	...	...	20·55	422·6	16·84	283·7	16·00	256·0	15·10	228·2
50	20·15	406·0	19·52	381·0	16·00	256·0	15·19	231·0	14·35	206·0
55	19·22	369·6	18·62	346·9	15·27	233·2	14·51	210·5	13·70	187·8
60	18·42	339·3	17·84	318·5	14·64	214·3	13·91	193·5	13·14	172·6
65	17·71	313·6	17·16	294·4	14·08	198·3	13·38	179·0	12·64	159·8
70	17·08	291·7	16·54	273·8	13·58	184·5	12·91	166·7	12·20	148·8
75	16·51	272·6	16·00	256·0	13·14	172·6	12·49	156·0	11·80	139·3
80	16·00	256·0	15·50	240·3	12·73	162·2	12·10	146·6	11·44	131·0
85	15·53	241·2	15·05	226·5	12·37	153·0	11·76	138·3	11·12	123·6
90	15·10	228·2	14·64	214·3	12·03	144·8	11·44	131·0	10·82	117·1
95	14·71	216·5	14·26	203·3	11·73	137·5	11·15	124·4	10·54	111·2
100	14·35	206·0	13·91	193·5	11·44	131·0	10·88	118·5	10·29	106·0
105	14·01	196·4	13·58	184·5	11·18	125·0	10·63	113·1	10·06	101·2
110	13·70	187·8	13·28	176·4	10·93	119·6	10·40	108·2	9·84	96·9
115	13·41	179·9	13·00	169·0	10·71	114·6	10·19	103·8	9·64	92·9
120	13·14	172·6	12·73	162·2	10·49	110·1	9·98	99·7	9·45	89·3
125	12·88	166·0	12·49	156·0	10·29	106·0	9·79	96·0	9·27	86·0
130	12·64	159·8	12·25	150·2	10·10	102·1	9·62	92·5	9·10	82·9
135	12·41	154·1	12·03	144·8	9·93	98·5	9·45	89·3	8·94	80·0
140	12·20	148·8	11·83	139·9	9·76	95·2	9·29	86·3	8·80	77·4
145	11·99	143·9	11·63	135·3	9·60	92·2	9·14	83·5	8·65	74·9
150	11·80	139·3	11·44	131·0	9·45	89·3	9·00	81·0	8·52	72·6
155	11·62	135·0	11·26	126·9	9·30	86·6	8·86	78·5	8·39	70·5
160	11·44	131·0	11·09	123·1	9·17	84·1	8·73	76·3	8·27	68·5
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{9}{16}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	16·43	270·0
20	19·52	381·0	18·53	343·5	18·33	336·0	14·28	204·0
25	17·49	306·0	16·61	276·0	16·43	270·0	12·82	164·4
30	16·00	256·0	15·19	231·0	15·03	226·0	11·74	138·0
35	14·84	220·2	14·10	198·8	13·94	194·5	10·91	119·1
40	13·91	193·5	13·22	174·7	13·07	171·0	10·24	105·0
45	13·14	172·6	12·49	156·0	12·35	152·6	9·69	94·0
50	12·49	156·0	11·87	141·0	11·74	138·0	9·23	85·2
55	11·93	142·3	11·34	128·7	11·22	126·0	8·83	78·0
60	11·44	131·0	10·88	118·5	10·77	116·0	8·48	72·0
65	11·01	121·3	10·48	109·8	10·37	107·5	8·18	66·9
70	10·63	113·1	10·12	102·4	10·01	100·2	7·91	62·5
75	10·29	106·0	9·79	96·0	9·69	94·0	7·66	58·8
80	9·98	99·7	9·50	90·3	9·40	88·5	7·45	55·5
85	9·70	94·2	9·24	85·4	9·14	83·6	7·25	52·5
90	9·45	89·3	9·00	81·0	8·90	79·3	7·07	50·0
95	9·21	84·9	8·77	77·0	8·68	75·4	6·90	47·6
100	9·00	81·0	8·57	73·5	8·48	72·0	6·75	45·6
105	8·80	77·4	8·38	70·2	8·29	68·8	6·61	43·7
110	8·61	74·1	8·20	67·3	8·12	66·0	6·48	42·0
115	8·44	71·2	8·04	64·6	7·96	63·3	6·35	40·4
120	8·27	68·5	7·89	62·2	7·81	61·0	6·24	39·0
125	8·12	66·0	7·74	60·0	7·66	58·8	6·13	37·6
130	7·98	63·6	7·61	57·9	7·53	56·7	6·00	36·0
135	7·84	61·5	7·48	56·0	7·40	54·8	5·87	34·4
140	7·71	59·5	7·36	54·2	7·29	53·1	5·75	33·0
145	7·59	57·7	7·25	52·5	7·17	51·5	5·63	31·7
150	7·48	56·0	7·14	51·0	7·07	50·0	5·55	30·8
155	7·37	54·3	7·04	49·5	6·97	48·5	5·43	29·4
160	7·27	52·8	6·94	48·1	6·87	47·2	5·33	28·4
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{19}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	20·48	419·4	19·32	373·5
35	...	...	...	...	19·99	399·7	18·98	360·3	17·91	321·0
40	...	...	...	...	18·72	350·5	17·77	316·0	16·78	281·6
45	...	...	...	...	17·67	312·2	16·78	281·6	15·84	251·0
50	...	...	20·48	419·4	16·78	281·6	15·94	254·0	15·05	226·5
55	20·17	406·9	19·54	381·8	16·01	256·5	15·21	231·5	14·36	206·4
60	19·32	373·5	18·72	350·5	15·35	235·6	14·58	212·7	13·77	189·7
65	18·58	345·2	18·00	324·0	14·76	218·0	14·03	196·8	13·25	175·6
70	17·91	321·0	17·35	301·3	14·24	202·8	13·53	183·1	12·78	163·5
75	17·32	300·0	16·78	281·6	13·77	189·7	13·09	171·3	12·37	153·0
80	16·78	281·6	16·26	264·3	13·35	178·2	12·69	161·0	11·99	143·8
85	16·29	265·4	15·78	249·1	12·96	168·1	12·32	151·9	11·65	135·7
90	15·84	251·0	15·35	235·6	12·61	159·1	11·99	143·8	11·33	128·5
95	15·43	238·1	14·95	223·5	12·29	151·0	11·68	136·5	11·04	122·0
100	15·05	226·5	14·58	212·7	11·99	143·8	11·40	130·0	10·78	116·2
105	14·69	216·0	14·24	202·8	11·71	137·2	11·14	124·1	10·53	111·0
110	14·36	206·4	13·92	193·9	11·45	131·2	10·89	118·7	10·30	106·2
115	14·06	197·7	13·63	185·7	11·21	125·8	10·67	113·8	10·09	101·8
120	13·77	189·7	13·35	178·2	10·99	120·8	10·45	109·3	9·89	97·8
125	13·50	182·4	13·09	171·3	10·78	116·2	10·25	105·2	9·70	94·2
130	13·25	175·6	12·84	165·0	10·58	112·0	10·07	101·4	9·53	90·8
135	13·01	169·3	12·61	159·1	10·39	108·0	9·89	97·8	9·36	87·6
140	12·78	163·5	12·39	153·6	10·22	104·4	9·72	94·5	9·20	84·7
145	12·57	158·0	12·18	148·5	10·05	101·0	9·56	91·5	9·05	82·0
150	12·37	153·0	11·99	143·8	9·89	97·8	9·41	88·6	8·91	79·5
155	12·17	148·2	11·80	139·3	9·74	94·9	9·27	86·0	8·78	77·1
160	11·99	143·8	11·62	135·1	9·59	92·1	9·13	83·5	8·65	74·9
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{19}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	17·23	297·0
20	20·48	419·4	19·44	378·0	19·23	369·8	14·97	224·2
25	18·35	336·7	17·42	303·6	17·23	297·0	13·44	180·6
30	16·78	281·6	15·94	254·0	15·76	248·5	12·31	151·5
35	15·56	242·2	14·78	218·6	14·62	213·9	11·43	130·7
40	14·58	212·7	13·85	192·0	13·70	187·9	10·73	115·1
45	13·77	189·7	13·09	171·3	12·95	167·7	10·15	103·0
50	13·09	171·3	12·44	154·8	12·31	151·5	9·66	93·3
55	12·50	156·3	11·88	141·3	11·76	138·3	9·24	85·3
60	11·99	143·8	11·40	130·0	11·28	127·2	8·87	78·7
65	11·54	133·2	10·97	120·4	10·86	117·9	8·55	73·1
70	11·14	124·1	10·59	112·3	10·48	109·9	8·26	68·3
75	10·78	116·2	10·25	105·2	10·15	103·0	8·01	64·2
80	10·45	109·3	9·95	99·0	9·84	96·9	7·78	60·5
85	10·16	103·2	9·67	93·5	9·57	91·6	7·57	57·3
90	9·89	97·8	9·41	88·6	9·32	86·8	7·38	54·5
95	9·64	93·0	9·18	84·3	9·08	82·5	7·20	51·9
100	9·41	88·6	8·96	80·4	8·87	78·7	7·04	49·6
105	9·20	84·7	8·76	76·8	8·67	75·3	6·89	47·5
110	9·01	81·1	8·58	73·6	8·49	72·1	6·76	45·6
115	8·82	77·9	8·41	70·7	8·32	69·2	6·63	43·9
120	8·65	74·9	8·24	68·0	8·16	66·6	6·51	42·3
125	8·49	72·1	8·09	65·5	8·01	64·2	6·39	40·9
130	8·34	69·6	7·95	63·2	7·87	61·9	6·29	39·5
135	8·20	67·2	7·81	61·1	7·74	59·9	6·19	38·3
140	8·06	65·0	7·69	59·1	7·61	57·9	6·08	37·0
145	7·93	63·0	7·57	57·3	7·49	56·1	5·96	35·5
150	7·81	61·1	7·45	55·6	7·38	54·5	5·84	34·1
155	7·70	59·3	7·35	54·0	7·27	52·9	5·73	32·9
160	7·59	57·6	7·24	52·5	7·17	51·4	5·63	31·7
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{5}{8}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	20·23	409·3
35	...	...	...	...	20·93	438·1	19·87	394·9	18·75	351·7
40	...	...	...	...	19·60	384·1	18·61	346·3	17·56	308·5
45	...	...	...	...	18·49	342·1	17·56	308·5	16·58	274·8
50	...	...	...	...	17·56	308·5	16·68	278·2	15·74	248·0
55	...	...	20·45	418·5	16·76	281·0	15·92	253·5	15·03	226·0
60	20·23	409·3	19·60	384·1	16·06	258·0	15·26	232·8	14·41	207·6
65	19·45	378·3	18·84	355·0	15·45	238·6	14·67	215·4	13·86	192·1
70	18·75	351·7	18·16	330·1	14·90	222·0	14·15	200·4	13·37	178·8
75	18·13	328·6	17·56	308·5	14·41	207·6	13·69	187·5	12·93	167·3
80	17·56	308·5	17·01	289·5	13·96	195·0	13·27	176·1	12·54	157·2
85	17·05	290·7	16·52	272·9	13·56	183·9	12·89	166·1	12·18	148·3
90	16·58	274·8	16·06	258·0	13·19	174·0	12·54	157·2	11·85	140·4
95	16·14	260·7	15·64	244·8	12·85	165·2	12·21	149·2	11·54	133·3
100	15·74	248·0	15·26	232·8	12·54	157·2	11·92	142·1	11·27	127·0
105	15·37	236·4	14·90	222·0	12·25	150·0	11·64	135·6	11·01	121·2
110	15·03	226·0	14·56	212·2	11·98	143·5	11·39	129·7	10·77	116·0
115	14·71	216·4	14·25	203·2	11·72	137·5	11·15	124·3	10·54	111·2
120	14·41	207·6	13·96	195·0	11·49	132·0	10·92	119·4	10·33	106·8
125	14·12	199·6	13·69	187·5	11·27	127·0	10·72	114·9	10·14	102·8
130	13·86	192·1	13·43	180·5	11·06	122·3	10·52	110·7	9·95	99·0
135	13·61	185·2	13·19	174·0	10·86	118·0	10·33	106·8	9·78	95·6
140	13·37	178·8	12·96	168·0	10·67	114·0	10·16	103·2	9·61	92·4
145	13·15	172·8	12·74	162·4	10·50	110·3	9·99	99·8	9·45	89·4
150	12·93	167·3	12·54	157·2	10·33	106·8	9·83	96·7	9·31	86·6
155	12·73	162·1	12·34	152·3	10·17	103·5	9·68	93·8	9·16	84·0
160	12·54	157·2	12·15	147·7	10·02	100·5	9·54	91·0	9·03	81·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{5}{8}$ inch thick.

TABLE No. 93 *continued.*

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	18·04	325·4
20	...	...	20·35	414·3	20·13	405·3	15·67	245·5
25	19·21	369·0	18·24	332·7	18·04	325·4	14·06	197·6
30	17·56	308·5	16·68	278·2	16·49	272·2	12·87	165·7
35	16·28	265·2	15·47	239·3	15·30	234·1	11·95	142·9
40	15·26	232·8	14·49	210·1	14·34	205·6	11·21	125·7
45	14·41	207·6	13·69	187·5	13·54	183·4	10·60	112·4
50	13·69	187·5	13·01	169·3	12·87	165·7	10·09	101·8
55	13·07	171·0	12·43	154·5	12·29	151·2	9·65	93·1
60	12·54	157·2	11·92	142·1	11·79	139·1	9·26	85·8
65	12·06	145·6	11·47	131·6	11·35	128·8	8·92	79·7
70	11·64	135·6	11·07	122·6	10·95	120·0	8·62	74·4
75	11·27	127·0	10·72	114·9	10·60	112·4	8·36	69·8
80	10·92	119·4	10·39	108·0	10·28	105·8	8·11	65·8
85	10·62	112·7	10·10	102·0	9·99	99·9	7·89	62·3
90	10·33	106·8	9·83	96·7	9·73	94·7	7·69	59·2
95	10·07	101·5	9·59	91·9	9·49	90·0	7·51	56·4
100	9·83	96·7	9·36	87·6	9·26	85·8	7·34	53·9
105	9·61	92·4	9·15	83·7	9·05	82·0	7·18	51·6
110	9·40	88·5	8·95	80·2	8·86	78·6	7·04	49·5
115	9·21	84·9	8·77	77·0	8·68	75·4	6·90	47·6
120	9·03	81·6	8·60	74·0	8·51	72·5	6·77	45·9
125	8·86	78·6	8·44	71·3	8·36	69·8	6·65	44·3
130	8 70	75·8	8·29	68·8	8·21	67·4	6·54	42·8
135	8·55	73·2	8·15	66·5	8·07	65·1	6·44	41·4
140	8·41	70·8	8·02	64·3	7·94	63·0	6·34	40·2
145	8·28	68·5	7·89	62·3	7·81	61·0	6·24	39·0
150	8·15	66·5	7·77	60·4	7·69	59·2	6·16	37·9
155	8·03	64·5	7·66	58·6	7·58	57·5	6·05	36·6
160	7·92	62·7	7·55	57·0	7·47	55·9	5·94	35·3
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{21}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	20·76	431·0	19·59	383·8
40	...	...	...	...	20·47	419·2	19·44	377·9	18·34	336·6
45	...	...	...	...	19·32	373·3	18·34	336·6	17·31	299·8
50	...	...	...	...	18·34	336·6	17·42	303·5	16·44	270·5
55	...	...	...	...	17·51	306·5	16·62	276·5	15·69	246·4
60	...	...	20·47	419·2	16·77	281·5	15·93	253·9	15·04	226·4
65	20·32	412·9	19·68	387·4	16·13	260·3	15·32	234·8	14·47	209·4
70	19·59	383·8	18·98	360·2	15·56	242·1	14·78	218·5	13·96	194·9
75	18·93	358·6	18·34	336·6	15·04	226·4	14·29	204·3	13·50	182·3
80	18·34	336·6	17·77	315·9	14·58	212·6	13·85	191·9	13·08	171·3
85	17·81	317·1	17·25	297·7	14·16	200·4	13·45	181·0	12·71	161·5
90	17·31	299·8	16·77	281·5	13·77	189·6	13·08	171·3	12·36	152·9
95	16·86	284·4	16·34	267·0	13·41	180·0	12·75	162·6	12·05	145·2
100	16·44	270·5	15·93	253·9	13·08	171·3	12·44	154·7	11·75	138·2
105	16·06	257·9	15·56	242·1	12·78	163·4	12·15	147·6	11·48	131·9
110	15·69	246·4	15·21	231·4	12·50	156·2	11·88	141·2	11·23	126·2
115	15·36	236·0	14·88	221·6	12·23	149·7	11·63	135·3	11·00	121·0
120	15·04	226·4	14·58	212·6	11·99	143·7	11·40	129·9	10·78	116·2
125	14·75	217·6	14·29	204·3	11·75	138·2	11·18	125·0	10·57	111·8
130	14·47	209·4	14·02	196·7	11·54	133·1	10·97	120·4	10·38	107·7
135	14·21	201·9	13·77	189·6	11·33	128·4	10·78	116·2	10·19	103·9
140	13·96	194·9	13·53	183·1	11·14	124·0	10·59	112·2	10·02	100·4
145	13·72	188·4	13·30	177·0	10·95	120·0	10·42	108·6	9·86	97·2
150	13·50	182·3	13·08	171·3	10·78	116·2	10·25	105·1	9·70	94·1
155	13·29	176·6	12·88	165·9	10·61	112·6	10·09	101·9	9·55	91·3
160	13·08	171·3	12·68	160·9	10·45	109·3	9·95	98·9	9·41	88·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{21}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch.	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	18·84	355·1
20	...	...	...	...	...	...	16·36	267·8
25	20·06	402·7	19·05	363·0	18·84	355·1	14·68	215·4
30	18·34	336·6	17·42	303·5	17·23	296·9	13·43	180·5
35	17·01	289·3	16·15	261·0	15·98	255·3	12·47	155·6
40	15·93	253·9	15·13	229·1	14·97	224·2	11·70	136·9
45	15·04	226·4	14·29	204·3	14·14	199·9	11·06	122·3
50	14·29	204·3	13·58	184·5	13·43	180·5	10·52	110·7
55	13·65	186·3	12·97	168·3	12·83	164·7	10·06	101·2
60	13·08	171·3	12·44	154·7	12·30	151·4	9·65	93·2
65	12·59	158·5	11·97	143·3	11·84	140·2	9·30	86·5
70	12·15	147·6	11·55	133·5	11·43	130·6	8·99	80·8
75	11·75	138·2	11·18	125·0	11·06	122·3	8·70	75·8
80	11·40	129·9	10·84	117·5	10·72	115·1	8·45	71·4
85	11·07	122·6	10·53	111·0	10·42	108·6	8·22	67·6
90	10·78	116·2	10·25	105·1	10·14	102·9	8·01	64·1
95	10·50	110·4	9·99	99·9	9·89	97·8	7·81	61·1
100	10·25	105·1	9·76	95·2	9·65	93·2	7·64	58·3
105	10·02	100·4	9·54	91·0	9·44	89·1	7·47	55·8
110	9·80	96·1	9·33	87·1	9·23	85·3	7·32	53·6
115	9·60	92·2	9·14	83·6	9·05	81·9	7·18	51·5
120	9·41	88·6	8·96	80·3	8·87	78·7	7·04	49·6
125	9·23	85·3	8·79	77·4	8·70	75·8	6·92	47·8
130	9·07	82·2	8·64	74·6	8·55	73·1	6·80	46·2
135	8·91	79·4	8·49	72·1	8·40	70·6	6·69	44·7
140	8·76	76·8	8·35	69·7	8·26	68·3	6·58	43·4
145	8·62	74·4	8·22	67·5	8·13	66·1	6·49	42·1
150	8·49	72·1	8·09	65·5	8·01	64·1	6·39	40·9
155	8·36	69·9	7·97	63·5	7·89	62·3	6·30	39·7
160	8·24	67·9	7·86	61·7	7·78	60·5	6·22	38·7
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{11}{16}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ns.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	20·43	417·4
40	...	...	...	...	...	...	20·27	411·0	19·13	366·0
45	...	...	...	...	20·15	406·0	19·13	366·0	18·05	326·0
50	...	...	...	...	19·13	366·0	18·16	330·0	17·14	294·0
55	...	...	...	...	18·25	333·2	17·33	300·5	16·36	267·8
60	...	...	...	...	17·49	306·0	16·61	276·0	15·68	246·0
65	...	...	20·52	421·3	16·82	282·9	15·97	255·2	15·08	227·5
70	20·43	417·4	19·79	391·7	16·22	263·1	15·40	237·4	14·55	211·7
75	19·74	390·0	19·13	366·0	15·68	246·0	14·90	222·0	14·07	198·0
80	19·13	366·0	18·53	343·5	15·19	231·0	14·44	208·5	13·63	186·0
85	18·57	344·8	17·99	323·6	14·75	217·7	14·02	196·5	13·24	175·4
90	18·05	326·0	17·49	306·0	14·35	206·0	13·63	186·0	12·88	166·0
95	17·58	309·1	17·03	290·2	13·98	195·4	13·28	176·5	12·55	157·5
100	17·14	294·0	16·61	276·0	13·63	186·0	12·96	168·0	12·24	150·0
105	16·74	280·2	16·22	263·1	13·32	177·4	12·66	160·2	11·96	143·1
110	16·36	267·8	15·85	251·4	13·02	169·6	12·38	153·2	11·70	136·9
115	16·01	256·4	15·51	240·7	12·74	162·5	12·11	146·8	11·45	131·2
120	15·68	246·0	15·19	231·0	12·49	156·0	11·87	141·0	11·22	126·0
125	15·37	236·4	14·90	222·0	12·24	150·0	11·64	135·6	11·01	121·2
130	15·08	227·5	14·61	213·6	12·02	144·4	11·42	130·6	10·80	116·7
135	14·81	219·3	14·35	206·0	11·80	139·3	11·22	126·0	10·61	112·6
140	14·55	211·7	14·10	198·8	11·60	134·5	11·03	121·7	10·43	108·8
145	14·30	204·6	13·86	192·2	11·40	130·1	10·85	117·7	10·26	105·3
150	14·07	198·0	13·63	186·0	11·22	126·0	10·67	114·0	10·10	102·0
155	13·85	191·8	13·42	180·1	11·05	122·1	10·51	110·5	9·94	98·9
160	13·63	186·0	13·22	174·7	10·88	118·5	10·35	107·2	9·79	96·0
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{11}{16}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	19·65	386·1
20	...	...	...	...	20·82	433·6	17·06	291·1
25	20·92	438·0	19·87	394·8	19·65	386·1	15·30	234·0
30	19·13	366·0	18·16	330·0	17·96	322·8	14·00	196·0
35	17·73	314·5	16·84	283·7	16·66	277·5	12·99	168·9
40	16·61	276·0	15·78	249·0	15·60	243·6	12·18	148·5
45	15·68	246·0	14·90	222·0	14·73	217·2	11·52	132·7
50	14·90	222·0	14·15	200·4	14·00	196·0	10·95	120·0
55	14·22	202·3	13·51	182·7	13·37	178·8	10·47	109·6
60	13·63	186·0	12·96	168·0	12·82	164·4	10·05	101·0
65	13·12	172·1	12·47	155·5	12·33	152·2	9·68	93·7
70	12·66	160·2	12·03	144·8	11·90	141·7	9·35	87·4
75	12·24	150·0	11·64	135·6	11·52	132·7	9·05	82·0
80	11·87	141·0	11·29	127·5	11·17	124·8	8·79	77·2
85	11·53	133·0	10·97	120·3	10·85	117·8	8·55	73·0
90	11·22	126·0	10·67	114·0	10·56	111·6	8·32	69·3
95	10·94	119·6	10·40	108·3	10·29	106·0	8·12	66·0
100	10·67	114·0	10·15	103·2	10·05	101·0	7·93	63·0
105	10·43	108·8	9·92	98·5	9·82	96·5	7·76	60·3
110	10·20	104·1	9·71	94·3	9·61	92·4	7·60	57·8
115	9·99	99·9	9·51	90·5	9·41	88·6	7·45	55·5
120	9·79	96·0	9·32	87·0	9·23	85·2	7·31	53·5
125	9·61	92·4	9·15	83·7	9·05	82·0	7·18	51·6
130	9·43	89·0	8·98	80·7	8·89	79·1	7·06	49·8
135	9·27	86·0	8·83	78·0	8·74	76·4	6·94	48·2
140	9·11	83·1	8·68	75·4	8·59	73·8	6·83	46·7
145	8·97	80·4	8·54	73·0	8·45	71·5	6·73	45·3
150	8·83	78·0	8·41	70·8	8·32	69·3	6·63	44·0
155	8·70	75·6	8·29	68·7	8·20	67·3	6·54	42·7
160	8·57	73·5	8·17	66·7	8·08	65·4	6·45	41·6
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{23}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	19·91	396·6
45	...	...	...	...	20·97	440·0	19·91	396·6	18·79	353·2
50	...	...	...	...	19·91	396·6	18·91	357·5	17·84	318·5
55	...	...	...	...	19·00	361·0	18·04	325·6	17·03	290·0
60	...	...	...	...	18·20	331·5	17·29	298·9	16·32	266·4
65	...	...	...	...	17·50	306·4	16·62	276·4	15·69	246·3
70	...	...	20·60	424·5	16·88	285·0	16·03	257·1	15·14	229·2
75	20·55	422·6	19·91	396·6	16·32	266·4	15·50	240·3	14·64	214·3
80	19·91	396·6	19·29	372·2	15·81	250·1	15·02	225·7	14·18	201·3
85	19·33	373·6	18·72	350·6	15·35	235·7	14·58	212·8	13·77	189·8
90	18·79	353·2	18·20	331·5	14·93	223·0	14·18	201·3	13·40	179·6
95	18·30	334·9	17·73	314·3	14·54	211·5	13·82	191·0	13·05	170·4
100	17·84	318·5	17·29	298·9	14·18	201·3	13·48	181·7	12·73	162·2
105	17·42	303·6	16·88	285·0	13·85	192·0	13·16	173·4	12·44	154·8
110	17·03	290·0	16·50	272·3	13·54	183·5	12·87	165·8	12·16	148·0
115	16·66	277·7	16·14	260·7	13·26	175·8	12·60	158·8	11·91	141·8
120	16·32	266·4	15·81	250·1	12·99	168·7	12·34	152·4	11·67	136·2
125	16·00	256·0	15·50	240·3	12·73	162·2	12·10	146·6	11·44	131·0
130	15·69	246·3	15·21	231·3	12·50	156·2	11·88	141·2	11·23	126·1
135	15·41	237·4	14·93	223·0	12·27	150·6	11·67	136·2	11·03	121·7
140	15·14	229·2	14·67	215·2	12·06	145·5	11·47	131·5	10·84	117·6
145	14·88	221·5	14·42	208·0	11·86	140·6	11·28	127·2	10·66	113·7
150	14·64	214·3	14·18	201·3	11·67	136·2	11·09	123·1	10·49	110·1
155	14·40	207·6	13·96	195·0	11·49	132·0	10·92	119·4	10·33	106·8
160	14·18	201·3	13·75	189·1	11·31	128·0	10·76	115·8	10·18	103·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{23}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	20·45	418·5
20	...	...	...	...	...	...	17·75	315·3
25	...	...	20·68	427·8	20·45	418·5	15·92	253·5
30	19·91	396·6	18·91	357·5	18·70	349·7	14·56	212·2
35	18·46	340·8	17·53	307·3	17·34	300·6	13·52	182·7
40	17·29	298·9	16·42	269·6	16·24	263·8	12·67	160·6
45	16·32	266·4	15·50	240·3	15·33	235·1	11·98	143·5
50	15·50	240·3	14·72	216·9	14·56	212·2	11·39	129·7
55	14·80	219·0	14·06	197·7	13·91	193·5	10·88	118·5
60	14·18	201·3	13·48	181·7	13·33	177·8	10·44	109·1
65	13·64	186·2	12·97	168·2	12·83	164·6	10·06	101·1
70	13·16	173·4	12·51	156·6	12·38	153·3	9·71	94·3
75	12·73	162·2	12·10	146·6	11·98	143·5	9·40	88·5
80	12·34	152·4	11·74	137·8	11·61	134·9	9·13	83·3
85	11·99	143·8	11·40	130·0	11·28	127·3	8·87	78·7
90	11·67	136·2	11·09	123·1	10·98	120·5	8·64	74·7
95	11·37	129·3	10·81	117·0	10·70	114·5	8·43	71·1
100	11·09	123·1	10·55	111·4	10·44	109·1	8·23	67·8
105	10·84	117·6	10·31	106·4	10·20	104·2	8·05	64·9
110	10·60	112·5	10·09	101·8	9·98	99·7	7·89	62·2
115	10·38	107·9	9·88	97·7	9·78	95·6	7·73	59·8
120	10·18	103·6	9·69	93·8	9·58	91·9	7·58	57·5
125	9·98	99·7	9·50	90·3	9·40	88·5	7·45	55·5
130	9·80	96·1	9·33	87·1	9·23	85·3	7·32	53·5
135	9·63	92·8	9·17	84·1	9·07	82·3	7·20	51·8
140	9·47	89·7	9·01	81·3	8·92	79·6	7·08	50·1
145	9·31	86·8	8·87	78·7	8·78	77·1	6·97	48·6
150	9·17	84·1	8·73	76·3	8·64	74·7	6·87	47·2
155	9·03	81·6	8·60	74·0	8·51	72·5	6·77	45·9
160	8·90	79·2	8·48	71·9	8·39	70·4	6·68	44·6
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{3}{4}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	20·70	428·5
45	...	...	...	...	...	...	20·70	428·5	19·53	381·5
50	...	...	...	...	20·70	428·5	19·65	386·2	18·54	344·0
55	...	...	...	...	19·75	390·0	18·75	351·6	17·70	313·2
60	...	...	...	...	18·92	358·0	17·96	322·8	16·96	287·6
65	...	...	...	...	18·19	331·0	17·27	298·5	16·31	266·0
70	...	...	...	...	17·54	307·7	16·66	277·6	15·73	247·4
75	...	...	20·70	428·5	16·96	287·6	16·10	259·5	15·21	231·3
80	20·70	428·5	20·05	402·0	16·43	270·0	15·61	243·6	14·74	217·2
85	20·09	403·6	19·46	378·7	15·95	254·5	15·15	229·6	14·31	204·8
90	19·53	381·5	18·92	358·0	15·51	240·7	14·74	217·2	13·92	193·7
95	19·02	361·7	18·42	339·5	15·11	228·3	14·35	206·1	13·56	183·8
100	18·54	344·0	17·96	322·8	14·74	217·2	14·00	196·0	13·22	175·0
105	18·10	327·9	17·54	307·7	14·39	207·1	13·67	187·0	12·92	166·9
110	17·70	313·2	17·14	294·0	14·07	198·0	13·37	178·8	12·63	159·6
115	17·31	299·9	16·78	281·5	13·77	189·6	13·09	171·3	12·36	152·9
120	16·96	287·6	16·43	270·0	13·49	182·0	12·82	164·4	12·11	146·8
125	16·62	276·4	16·11	259·5	13·22	175·0	12·57	158·1	11·88	141·2
130	16·31	266·0	15·80	249·7	12·98	168·5	12·33	152·2	11·66	136·0
135	16·01	256·3	15·51	240·7	12·74	162·4	12·11	146·8	11·45	131·1
140	15·73	247·4	15·24	232·3	12·52	156·8	11·90	141·8	11·25	126·7
145	15·46	239·1	14·98	224·5	12·31	151·6	11·71	137·1	11·07	122·5
150	15·21	231·3	14·74	217·2	12·11	146·8	11·52	132·7	10·89	118·6
155	14·97	224·0	14·50	210·4	11·92	142·2	11·34	128·6	10·72	115·0
160	14·74	217·2	14·28	204·0	11·74	138·0	11·17	124·8	10·56	111·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{3}{4}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	..	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	18·45	340·6
25	...	...	...	...	...	...	16·54	273·6
30	20·70	428·5	19·65	386·2	19·43	377·8	15·13	229·0
35	19·18	368·1	18·21	331·9	18·02	324·6	14·04	197·2
40	17·96	322·8	17·06	291·1	16·87	284·8	13·16	173·3
45	16·96	287·6	16·10	259·5	15·93	253·8	12·43	154·7
50	16·11	259·5	15·30	234·1	15·13	229·0	11·82	139·8
55	15·37	236·4	14·60	213·4	14·45	208·8	11·30	127·6
60	14·74	217·2	14·00	196·0	13·85	191·9	10·84	117·5
65	14-17	201·0	13·47	181·5	13·32	177·6	10·43	108·9
70	13·67	187·0	12·99	168·9	12·85	165·3	10·08	101·6
75	13·22	175·0	12·57	158·1	12·43	154·7	9·75	95·2
80	12·82	164·4	12·19	148·5	12·06	145·4	9·46	89·6
85	12·45	155·1	11·84	140·2	11·71	137·2	9·20	84·7
90	12·11	146·8	11·52	132·7	11·39	129·9	8·96	80·3
95	11·80	139·4	11·22	126·0	11·11	123·4	8·74	76·4
100	11·52	132·7	10·95	120·0	10·84	117·5	8·54	72·9
105	11·25	126·7	10·70	114·6	10·59	112·2	8·35	69·7
110	11·01	121·2	10·47	109·7	10·36	107·4	8·17	66·8
115	10·78	116·2	10·25	105·1	10·14	102·9	8·01	64·1
120	10·56	111·6	10·05	101·0	9·94	98·9	7·86	61·7
125	10·36	107·4	9·86	97·2	9·75	95·2	7·71	59·5
130	10·17	103·5	9·68	93·7	9·58	91·8	7·58	57·4
135	9·99	99·8	9·51	90·5	9·41	88·6	7·45	55·5
140	9·82	96·5	9·35	87·4	9·25	85·6	7·33	53·8
145	9·66	93·4	9·20	84·6	9·10	82·9	7·22	52·1
150	9·51	90·5	9·05	82·0	8·96	80·3	7·11	50·6
155	9·36	87·7	8·92	79·5	8·83	77·9	7·01	49·1
160	9·23	85·2	8·79	77·2	8·70	75·7	6·91	47·8
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.
Steel Plate $\frac{25}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	20·27	411·0
50	...	...	...	...	...	...	20·39	416·0	19·24	370·5
55	...	...	...	...	20·49	420·2	19·46	378·7	18·36	337·3
60	...	...	...	...	19·63	385·6	18·64	347·7	17·60	309·7
65	...	...	...	...	18·88	356·4	17·92	321·4	16·92	286·3
70	...	...	...	...	18·20	331·4	17·28	298·9	16·32	266·3
75	...	...	...	...	17·60	309·7	16·71	279·3	15·78	249·0
80	...	...	20·81	433·1	17·05	290·7	16·19	262·2	15·29	233·8
85	20·85	434·8	20·20	408·0	16·55	274·0	15·72	247·2	14·84	220·4
90	20·27	411·0	19·63	385·6	16·09	259·1	15·29	233·8	14·44	208·5
95	19·74	389·6	19·12	365·7	15·67	245·8	14·89	221·8	14·06	197·8
100	19·24	370·5	18·64	347·7	15·29	233·8	14·52	211·0	13·72	188·2
105	18·79	353·1	18·20	331·4	14·93	222·9	14·18	201·2	13·40	179·5
110	18·36	337·3	17·79	316·6	14·59	213·1	13·87	192·3	13·10	171·6
115	17·97	322·9	17·41	303·1	14·28	204·0	13·57	184·2	12·82	164·4
120	17·60	309·7	17·05	290·7	13·99	195·8	13·29	176·8	12·56	157·8
125	17·25	297·6	16·71	279·3	13·72	188·2	13·04	170·0	12·32	151·8
130	16·92	286·3	16·39	268·8	13·46	181·2	12·79	163·7	12·09	146·1
135	16·61	276·0	16·09	259·1	13·22	174·7	12·56	157·8	11·87	141·0
140	16·32	266·3	15·81	250·0	12·99	168·7	12·34	152·4	11·67	136·1
145	16·04	257·3	15·54	241·6	12·77	163·1	12·14	147·4	11·47	131·6
150	15·78	249·0	15·29	233·8	12·56	157·8	11·94	142·6	11·29	127·5
155	15·53	241·1	15·04	226·4	12·36	152·9	11·76	138·2	11·11	123·5
160	15·29	233·8	14·81	219·5	12·18	148·3	11·58	134·1	10·95	119·9
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{25}{32}$ inch thick.

Pressure per sq. in.	$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	19·15	366·8
25	...	...	...	...	...	...	17·16	294·6
30	...	...	20·39	416·0	20·17	406·9	15·70	246·5
35	19·91	396·5	18·90	357·4	18·70	349·6	14·56	212·2
40	18·64	347·7	17·70	313·5	17·51	306·7	13·65	186·4
45	17·60	309·7	16·71	279·3	16·53	273·3	12·89	166·3
50	16·71	279·3	15·87	252·0	15·70	246·5	12·26	150·3
55	15·95	254·5	15·15	229·6	14·99	224·7	11·71	137·2
60	15·29	233·8	14·52	211·0	14·37	206·4	11·23	126·2
65	14·70	216·2	13·97	195·2	13·82	191·0	10·81	117·0
70	14·18	201·2	13·48	181·7	13·33	177·8	10·44	109·1
75	13·72	188·2	13·04	170·0	12·89	166·3	10·11	102·2
80	13·29	176·8	12·64	159·7	12·50	156·3	9·80	96·2
85	12·91	166·8	12·27	150·7	12·14	147·5	9·53	90·9
90	12·56	157·8	11·94	142·6	11·81	139·6	9·28	86·1
95	12·24	149·8	11·64	135·4	11·51	132·6	9·05	81·9
100	11·94	142·6	11·35	129·0	11·23	126·2	8·84	78·1
105	11·67	136·1	11·09	123·1	10·98	120·5	8·64	74·7
110	11·41	130·2	10·85	117·8	10·74	115·3	8·46	71·6
115	11·17	124·8	10·62	112·9	10·51	110·5	8·29	68·7
120	10·95	119·9	10·41	108·5	10·30	106·2	8·13	66·1
125	10·74	115·3	10·21	104·4	10·11	102·2	7·98	63·7
130	10·54	111·1	10·03	100·6	9·92	98·5	7·84	61·5
135	10·35	107·2	9·85	97·1	9·75	95·1	7·71	59·4
140	10·18	103·6	9·68	93·8	9·58	91·9	7·58	57·5
145	10·01	100·2	9·53	90·8	9·43	88·9	7·46	55·7
150	9·85	97·1	9·38	88·0	9·28	86·1	7·35	54·1
155	9·70	94·1	9·24	85·3	9·14	83·6	7·25	52·5
160	9·56	91·4	9·10	82·8	9·01	81·1	7·14	51·1
	$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces
Steel Plate $\frac{13}{16}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	19·95	398·0
55	...	...	...	...	...	...	20·17	406·9	19·03	362·3
60	...	...	...	...	20·35	414·3	19·32	373·5	18·24	332·6
65	...	...	...	...	19·56	382·9	18·58	345·2	17·53	307·5
70	...	...	...	...	18·86	356·0	17·91	321·0	16·91	286·0
75	...	...	...	...	18·24	332·6	17·32	300·0	16·35	267·3
80	...	...	...	...	17·67	312·2	16·78	281·6	15·84	251·0
85	...	...	20·93	438·3	17·15	294·2	16·29	265·4	15·38	236·5
90	...	...	20·35	414·3	16·68	278·2	15·84	251·0	14·96	223·7
95	20·46	418·6	19·82	392·8	16·24	263·8	15·43	238·1	14·57	212·3
100	19·95	398·0	19·32	373·5	15·84	251·0	15·05	226·5	14·21	202·0
105	19·47	379·3	18·86	356·0	15·47	239·3	14·69	216·0	13·88	192·6
110	19·03	362·3	18·44	340·0	15·12	228·7	14·36	206·4	13·57	184·1
115	18·62	346·8	18·04	325·5	14·80	219·0	14·06	197·7	13·28	176·4
120	18·24	332·6	17·67	312·2	14·49	210·1	13·77	189·7	13·01	169·3
125	17·87	319·6	17·32	300·0	14·21	202·0	13·50	182·4	12·76	162·8
130	17·53	307·5	16·99	288·6	13·94	194·4	13·25	175·6	12·52	156·7
135	17·21	296·3	16·68	278·2	13·69	187·4	13·01	169·3	12·29	151·1
140	16·91	286·0	16·38	268·5	13·45	181·0	12·78	163·5	12·08	146·0
145	16·62	276·3	16·10	259·4	13·22	174·9	12·57	158·0	11·88	141·1
150	16·35	267·3	15·84	251·0	13·01	169·3	12·37	153·0	11·69	136·6
155	16·09	258·9	15·59	243·0	12·80	164·0	12·17	148·2	11·50	132·4
160	15·84	251·0	15·35	235·6	12·61	159·1	11·99	143·8	11·33	128·5
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{13}{16}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	..
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	19·85	394·0
25	...	...	...	...	...	...	17·79	316·4
30	...	...	...	...	20·91	437·2	16·27	264·7
35	20·64	426·0	19·59	384·0	19·38	375·6	15·09	227·7
40	19·32	373·5	18·35	336·7	18·15	329·4	14·14	200·0
45	18·24	332·6	17·32	300·0	17·13	293·4	13·36	178·4
50	17·32	300·0	16·45	270·6	16·27	264·7	12·69	161·2
55	16·53	273·2	15·70	246·5	15·53	241·2	12·13	147·1
60	15·84	251·0	15·05	226·5	14·88	221·6	11·63	135·3
65	15·23	232·1	14·47	209·5	14·31	205·0	11·19	125·4
70	14·69	216·0	13·96	195·0	13·81	190·8	10·81	116·8
75	14·21	202·0	13·50	182·4	13·36	178·4	10·46	109·4
80	13·77	189·7	13·09	171·3	12·95	167·7	10·15	103·0
85	13·37	178·9	12·71	161·6	12·57	158·1	9·86	97·3
90	13·01	169·3	12·37	153·0	12·23	149·7	9·60	92·2
95	12·67	160·7	12·05	145·2	11·92	142·1	9·36	87·7
100	12·37	153·0	11·76	138·3	11·63	135·3	9·14	83·6
105	12·08	146·0	11·49	132·0	11·36	129·2	8·94	79·9
110	11·81	139·6	11·23	126·2	11·11	123·6	8·75	76·5
115	11·56	133·8	11·00	121·0	10·88	118·4	8·57	73·4
120	11·33	128·5	10·78	116·2	10·66	113·8	8·40	70·6
125	11·11	123·6	10·57	111·8	10·46	109·4	8·25	68·0
130	10·91	119·0	10·38	107·7	10·27	105·5	8·10	65·7
135	10·71	114·8	10·19	104·0	10·09	101·8	7·96	63·4
140	10·53	111·0	10·02	100·5	9·92	98·4	7·83	61·4
145	10·36	107·3	9·86	97·2	9·75	95·2	7·71	59·5
150	10·19	104·0	9·70	94·2	9·60	92·2	7·59	57·7
155	10·04	100·8	9·55	91·3	9·45	89·4	7·48	56·0
160	9·89	97·8	9·41	88·6	9·32	86·8	7·38	54·5
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{27}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	..	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	..	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	20·65	426·5
55	...	...	...	...	...	...	...	...	19·70	388·2
60	...	...	...	...	...	...	20·00	400·0	18·87	356·4
65	...	...	...	...	20·25	410·3	19·23	369·8	18·15	329·4
70	...	...	...	...	19·53	381·4	18·54	343·9	17·50	306·3
75	...	...	...	...	18·88	356·4	17·92	321·3	16·92	286·3
80	...	...	...	...	18·29	334·5	17·36	301·6	16·39	268·8
85	...	...	...	...	17·75	315·1	16·86	284·2	15·91	253·3
90	...	...	...	...	17·26	298·0	16·39	268·8	15·48	239·6
95	...	...	20·51	420·9	16·81	282·6	15·96	254·9	15·07	227·3
100	20·65	426·5	20·00	400·0	16·39	268·8	15·57	242·5	14·70	216·2
105	20·16	406·4	19·53	381·4	16·01	256·2	15·20	231·2	14·36	206·2
110	19·70	388·2	19·08	364·3	15·65	244·9	14·86	221·0	14·04	197·1
115	19·27	371·6	18·67	348·7	15·31	234·5	14·55	211·6	13·74	188·8
120	18·87	356·4	18·29	334·5	15·00	225·0	14·25	203·1	13·46	181·2
125	18·50	342·4	17·92	321·3	14·70	216·2	13·97	195·2	13·19	174·2
130	18·15	329·4	17·58	309·2	14·42	208·1	13·71	187·9	12·95	167·7
135	17·81	317·4	17·26	298·0	14·16	200·6	13·46	181·2	12·71	161·7
140	17·50	306·3	16·95	287·5	13·91	193·7	13·22	174·9	12·49	156·1
145	17·20	296·0	16·67	277·8	13·68	187·2	13·00	169·0	12·28	151·0
150	16·92	286·3	16·39	268·8	13·46	181·2	12·79	163·6	12·09	146·1
155	16·65	277·2	16·13	260·3	13·25	175·5	12·59	158·6	11·90	141·6
160	16·39	268·8	15·88	252·3	13·04	170·2	12·40	153·8	11·72	137·4
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.
Steel Plate $\frac{27}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	20·55	422·2
25	...	...	...	...	...	...	18·41	339·0
30	...	...	...	...	...	...	16·83	283·5
35	...	...	20·28	411·4	20·06	402·4	15·61	243·8
40	20·00	400·0	18·99	360·7	18·78	352·9	14·63	214·1
45	18·87	356·4	17·92	321·3	17·73	314·3	13·82	191·0
50	17·92	321·3	17·02	289·8	16·83	283·5	13·13	172·5
55	17·10	292·7	16·25	264·0	16·07	258·3	12·54	157·3
60	16·39	268·8	15·57	242·5	15·40	237·2	12·03	144·7
65	15·76	248·5	14·97	224·3	14·81	219·4	11·58	134·0
70	15·20	231·2	14·44	208·7	14·29	204·2	11·17	124·9
75	14·70	216·2	13·97	195·2	13·82	191·0	10·81	117·0
80	14·25	203·1	13·54	183·3	13·39	179·4	10·49	110·0
85	13·83	191·5	13·15	172·9	13·01	169·2	10·19	103·9
90	13·46	181·2	12·79	163·6	12·65	160·1	9·92	98·5
95	13·11	171·9	12·46	155·3	12·33	152·0	9·67	93·6
100	12·79	163·6	12·16	147·9	12·03	144·7	9·44	89·2
105	12·49	156·1	11·88	141·1	11·75	138·1	9·23	85·2
110	12·22	149·3	11·62	135·0	11·49	132·1	9·03	81·6
115	11·96	143·1	11·37	129·4	11·25	126·6	8·85	78·3
120	11·72	137·4	11·14	124·2	11·02	121·6	8·68	75·3
125	11·49	132·1	10·93	119·5	10·81	117·0	8·52	72·6
130	11·28	127·2	10·73	115·1	10·61	112·7	8·37	70·0
135	11·08	122·8	10·54	111·1	10·43	108·7	8·22	67·6
140	10·89	118·6	10·36	107·3	10·25	105·1	8·09	65·4
145	10·71	114·7	10·19	103·8	10·08	101 7	7·96	63·4
150	10·54	111·1	10·03	100·6	9·92	98·5	7·84	61·5
155	10·38	107·7	9·87	97·5	9·77	95·5	7·72	59·7
160	10·22	104·5	9·73	94·7	9·63	92·7	7·61	58·0
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{7}{8}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	..	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	20·37	415·0
60	...	...	...	...	...	...	20·68	427·8	19·52	381·0
65	...	...	...	...	20·94	438·6	19·88	395·4	18·76	352·1
70	...	...	...	...	20·19	407·7	19·17	367·6	18·09	327·4
75	...	...	...	...	19·52	381·0	18·53	343·5	17·49	306·0
80	...	...	...	...	18·91	357·5	17·95	322·4	16·94	287·2
85	...	...	...	...	18·35	336·8	17·43	303·7	16·45	270·7
90	...	...	...	...	17·84	318·5	16·94	287·2	16·00	256·0
95	...	...	...	...	17·38	302·0	16·50	272·4	15·58	242·8
100	...	...	20·68	427·8	16·94	287·2	16·09	259·1	15·19	231·0
105	20·84	434·5	20·19	407·7	16·54	273·8	15·71	247·0	14·84	220·2
110	20·37	415·0	19·73	389·5	16·17	261·6	15·36	236·1	14·51	210·5
115	19·93	397·3	19·31	372·8	15·83	250·5	15·03	226·1	14·20	201·6
120	19·52	381·0	18·91	357·5	15·50	240·3	14·72	216·9	13·91	193·5
125	19·13	366·0	18·53	343·5	15·19	231·0	14·44	208·5	13·63	186·0
130	18·76	352·1	18·18	330·5	14·91	222·3	14·16	200·7	13·38	179·0
135	18·42	339·3	17·84	318·5	14·64	214·3	13·91	193·5	13·14	172·6
140	18·09	327·4	17·53	307·3	14·38	206·8	13·66	186·8	12·91	166·7
145	17·78	316·3	17·23	296·9	14·14	199·9	13·43	180·5	12·69	161·1
150	17·49	306·0	16·94	287·2	13·91	193·5	13·22	174·7	12·49	156·0
155	17·21	296·3	16·67	278·1	13·69	187·4	13·01	169·3	12·29	151·1
160	16·94	287·2	16·42	269·6	13·48	181·7	12·81	164·2	12·10	146·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{7}{8}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	19·03	362·4
30	...	...	...	...	...	...	17·40	303·0
35	...	...	20·97	439·9	20·74	430·2	16·14	260·5
40	20·68	427·8	19·63	385·6	19·42	377·2	15·12	228·7
45	19·52	381·0	18·53	343·5	18·33	336·0	14·28	204·0
50	18·53	343·5	17·60	309·7	17·40	303·0	13·57	184·2
55	17·68	312·8	16·79	282·1	16·61	276·0	12·96	168·0
60	16·94	287·2	16·09	259·1	15·92	253·5	12·43	154·5
65	16·29	265·6	15·48	239·6	15·31	234·4	11·96	143·0
70	15·71	247·0	14·93	222·9	14·77	218·1	11·54	133·2
75	15·19	231·0	14·44	208·5	14·28	204·0	11·17	124·8
80	14·72	216·9	13·99	195·8	13·84	191·6	10·83	117·3
85	14·30	204·5	13·59	184·6	13·44	180·7	10·52	110·8
90	13·91	193·5	13·22	174·7	13·07	171·0	10·24	105·0
95	13·55	183·6	12·87	165·8	12·74	162·3	9·99	99·7
100	13·22	174·7	12·56	157·8	12·43	154·5	9·75	95·1
105	12·91	166·7	12·27	150·6	12·14	147·4	9·53	90·8
110	12·62	159·4	12·00	144·0	11·87	141·0	9·32	87·0
115	12·35	152·7	11·75	138·0	11·62	135·1	9·13	83·4
120	12·10	146·6	11·51	132·5	11·39	129·7	8·95	80·2
125	11·87	141·0	11·29	127·5	11·17	124·8	8·79	77·2
130	11·65	135·8	11·08	122·8	10·96	120·2	8·63	74·5
135	11·44	131·0	10·88	118·5	10·77	116·0	8·48	72·0
140	11·24	126·5	10·70	114·4	10·58	112·0	8·34	69·6
145	11·06	122·3	10·52	110·7	10·41	108·4	8·21	67·4
150	10·88	118·5	10·35	107·2	10·24	105·0	8·08	65·4
155	10·71	114·8	10·19	103·9	10·09	101·8	7·96	63·4
160	10·55	111·4	10·04	100·9	9·94	98·8	7·85	61·6
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{29}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	20·16	406·4
65	...	...	...	...	...	...	20·53	421·8	19·38	375·6
70	...	...	...	...	20·85	435·0	19·80	392·1	18·68	349·2
75	...	...	...	...	20·16	406·4	19·14	366·3	18·06	326·3
80	...	...	...	...	19·53	381·3	18·54	343·8	17·50	306·3
85	...	...	...	...	18·95	359·3	18·00	324·0	16·99	288·6
90	...	...	...	...	18·43	339·6	17·50	306·3	16·52	272·9
95	...	...	...	...	17·94	322·1	17·04	290·5	16·09	258·8
100	...	...	...	...	17·50	306·3	16·62	276·2	15·69	246·2
105	...	...	20·85	435·0	17·08	292·0	16·23	263·4	15·32	234·8
110	...	...	20·38	415·5	16·70	279·0	15·86	251·7	14·98	224·4
115	20·58	423·8	19·94	397·7	16·34	267·1	15·52	241·0	14·66	214·9
120	20·16	406·4	19·53	381·3	16·00	256·0	15·20	231·2	14·36	206·2
125	19·75	390·4	19·14	366·3	15·69	246·2	14·90	222·2	14·07	198·2
130	19·38	375·6	18·77	352·5	15·39	237·0	14·62	213·9	13·81	190·8
135	19·02	361·9	18·43	339·6	15·11	228·4	14·36	206·2	13·56	183·9
140	18·68	349·2	18·10	327·7	14·85	220·5	14·10	199·0	13·32	177·6
145	18·36	337·3	17·79	316·6	14·59	213·1	13·87	192·4	13·10	171·6
150	18·06	326·3	17·50	306·3	14·36	206·2	13·64	186·1	12·89	166·1
155	17·77	316·0	17·22	296·6	14·13	199·7	13·43	180·3	12·68	161·0
160	17·50	306·3	16·95	287·5	13·91	193·6	13·22	174·9	12·49	156·1
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{29}{32}$ inch thick.

Pressure per sq. in.	$*F_1G_1$ Pitch	$*F_1G_1$ Surface	$*H_1$ Pitch	$*H_1$ Surface	$*r\ G_1$ Pitch	$*r\ G_1$ Surface	$*I_1$ Pitch	$*I_1$ Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	19·66	386·5
30	...	...	...	...	...	...	17·97	323·1
35	...	...	...	...	...	...	16·66	277·8
40	...	...	20·28	411·4	20·06	402·4	15·61	243·8
45	20·16	406·4	19·14	366·3	18·93	358·3	14·74	217·4
50	19·14	366·3	18·17	330·3	17·97	323·1	14·01	196·2
55	18·26	333·6	17·34	300·8	17·15	294·3	13·37	178·9
60	17·50	306·3	16·62	276·2	16·44	270·2	12·82	164·5
65	16·82	283·2	15·98	255·4	15·81	249·9	12·34	152·3
70	16·23	263·4	15·41	237·6	15·24	232·5	11·91	141·9
75	15·69	246·2	14·90	222·2	14·74	217·4	11·52	132·8
80	15·20	231·2	14·44	208·7	14·29	204·2	11·17	124·9
85	14·76	217·9	14·02	196·7	13·87	192·5	10·86	117·9
90	14·36	206·2	13·64	186·1	13·49	182·1	10·57	111·7
95	13·98	195·6	13·29	176·7	13·15	172·9	10·30	106·1
100	13·64	186·1	12·96	168·1	12·82	164·5	10·05	101·1
105	13·32	177·6	12·66	160·4	12·53	157·0	9·82	96·6
110	13·03	169·8	13·38	153·4	12·25	150·1	9·61	92·5
115	12·75	162·6	12·12	147·0	11·99	143·8	9·42	88·7
120	12·49	156·1	11·88	141·1	11·75	138·1	9·23	85·2
125	12·25	150·1	11·65	135·7	11·52	132·8	9·06	82·1
130	12·02	144·6	11·43	130·7	11·31	127·9	8·89	79·1
135	11·81	139·4	11·23	126·1	11·11	123·4	8·74	76·4
140	11·60	134·7	11·03	121·8	10·92	119·2	8·60	73·9
145	11·41	130·2	10·85	117·8	10·74	115·3	8·46	71·6
150	11·23	126·1	10·68	114·1	10·57	111·7	8·34	69·6
155	11·05	122·2	10·51	110·6	10·40	108·3	8·20	67·3
160	10·89	118·6	10·36	107·3	10·25	105·1	8·09	65·4
	$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{15}{16}$ inch thick

Pressure per sq.in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	20·80	432·6
65	...	...	...	...	...	...	...	...	19·99	399·8
70	...	...	...	...	...	...	20·43	417·4	19·28	371·7
75	...	...	...	...	20·80	432·6	19·74	390·0	18·63	347·3
80	...	...	...	...	20·15	406·0	19·13	366·0	18·05	326·0
85	...	...	...	...	19·55	382·4	18·57	344·8	17·52	307·1
90	...	...	...	...	19·01	361·5	18·05	326·0	17·04	290·4
95	...	...	...	...	18·51	342·8	17·58	309·1	16·59	275·4
100	...	...	...	...	18·05	326·0	17·14	294·0	16·18	262·0
105	...	...	...	...	17·62	310·7	16·74	280·2	15·80	249·8
110	...	...	...	...	17·23	296·9	16·36	267·8	15·45	238·7
115	...	...	20·57	423·3	16·86	284·2	16·01	256·4	15·12	228·6
120	20·80	432·6	20·15	406·0	16·51	272·6	15·68	246·0	14·81	219·3
125	20·38	415·6	19·74	390·0	16·18	262·0	15·37	236·4	14·51	210·8
130	19·99	399·8	19·37	375·2	15·88	252·1	15·08	227·5	14·24	202·9
135	19·62	385·2	19·01	361·5	15·59	243·0	14·81	219·3	13·98	195·6
140	19·28	371·7	18·67	348·8	15·31	234·5	14·55	211·7	13·74	188·8
145	18·95	359·1	18·35	337·0	15·05	226·6	14·30	204·6	13·51	182·5
150	18·63	347·3	18·05	326·0	14·81	219·3	14·07	198·0	13·29	176·6
155	18·34	336·3	17·76	315·6	14·57	212·4	13·85	191·8	13·08	171·1
160	18·05	326·0	17·49	306·0	14·35	206·0	13·63	186·0	12·88	166·0
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{15}{16}$ inch thick.

Pressure per sq. in.	$*F_1G_1$		$*H_1$		$*r\,G_1$		$*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	20·28	411·5
30	...	...	...	...	...	...	18·54	343·9
35	...	...	...	...	...	...	17·19	295·6
40	...	...	20·92	438·0	20·69	428·4	16·10	259·4
45	20·80	432·6	19·74	390·0	19·53	381·4	15·20	231·2
50	19·74	390·0	18·75	351·6	18·54	343·9	14·44	208·7
55	18·84	355·0	17·89	320·1	17·69	313·2	13·79	190·3
60	18·05	326·0	17·14	294·0	16·95	287·6	13·22	174·9
65	17·36	301·3	16·48	271·8	16·30	265·9	12·72	161·9
70	16·74	280·2	15·90	252·8	15·72	247·3	12·28	150·8
75	16·18	262·0	15·37	236·4	15·20	231·2	11·88	141·1
80	15·68	246·0	14·90	222·0	14·73	217·2	11·52	132·7
85	15·22	231·8	14·46	209·2	14·31	204·7	11·19	125·2
90	14·81	219·3	14·07	198·0	13·91	193·7	10·89	118·6
95	14·42	208·1	13·70	187·8	13·56	183·8	10·61	112·7
100	14·07	198·0	13·37	178·8	13·22	174·9	10·36	107·3
105	13·74	188·8	13·06	170·5	12·92	166·9	10·12	102·5
110	13·43	180·5	12·77	163·0	12·63	159·6	9·90	98·1
115	13·15	172·9	12·50	156·2	12·36	152·9	9·70	94·1
120	12·88	166·0	12·24	150·0	12·11	146·8	9·51	90·4
125	12·63	159·6	12·01	144·2	11·88	141·1	9·33	87·1
130	12·39	153·6	11·78	138·9	11·66	135·9	9·16	83·9
135	12·17	148·2	11·57	134·0	11·45	131·1	9·00	81·0
140	11·96	143·1	11·37	129·4	11·25	126·6	8·85	78·4
145	11·76	138·4	11·18	125·1	11·07	122·5	8·71	75·9
150	11·57	134·0	11·01	121·2	10·89	118·6	8·57	73·5
155	11·39	129·8	10·83	117·4	10·72	115·0	8·45	71·4
160	11·22	126·0	10·67	114·0	10·56	111·6	8·32	69·3
	$*F_1G_1$		$*H_1$		$*r\,G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{3}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...	20·61	424·8
70	...	...	...	...	...	...	...	...	19·87	394·9
75	...	...	...	...	...	...	20·35	414·3	19·21	369·0
80	...	...	...	...	20·77	431·3	19·72	388·8	18·61	346·3
85	...	...	...	...	20·15	406·3	19·14	366·3	18·06	326·2
90	...	...	...	...	19·60	384·1	18·61	346·3	17·56	308·5
95	...	...	...	...	19·08	364·2	18·12	328·4	17·10	292·5
100	...	...	...	...	18·61	346·3	17·67	312·2	16·68	278·2
105	...	...	...	...	18·16	330·1	17·25	297·6	16·28	265·2
110	...	...	...	...	17·75	315·3	16·86	284·4	15·92	253·5
115	...	...	...	...	17·37	301·9	16·50	272·3	15·58	242·7
120	...	...	20·77	431·3	17·01	289·5	16·16	261·2	15·26	232·8
125	...	...	20·35	414·3	16·68	278·2	15·84	251·0	14·96	223·8
130	20·61	424·8	19·96	398·6	16·36	267·7	15·54	241·6	14·67	215·4
135	20·23	409·3	19·60	384·1	16·06	258·0	15·26	232·8	14·41	207·6
140	19·87	394·9	19·25	370·6	15·78	249·0	14·99	224·7	14·15	200·4
145	19·53	381·5	18·92	358·0	15·51	240·6	14·73	217·2	13·92	193·7
150	19·21	369·0	18·61	346·3	15·26	232·8	14·49	210·1	13·69	187·5
155	18·90	357·2	18·31	335·3	15·01	225·5	14·26	203·6	13·47	181·6
160	18·61	346·3	18·02	325·0	14·78	218·6	14·05	197·4	13·27	176·1
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{3}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	20·91	437·2
30	...	...	...	...	...	...	19·11	365·3
35	...	...	...	...	...	...	17·72	314·0
40	...	...	...	...	...	...	16·60	275·5
45	...	...	20·35	414·3	20·13	405·3	15·67	245·5
50	20·35	414·3	19·32	373·5	19·11	365·3	14·88	221·6
55	19·42	377·2	18·44	340·1	18·24	332·7	14·21	202·0
60	18·61	346·3	17·67	312·2	17·47	305·4	13·62	185·6
65	17·89	320·1	16·99	288·7	16·80	282·4	13·11	171·8
70	17·25	297·6	16·38	268·5	16·20	262·6	12·65	160·0
75	16·68	278·2	15·84	251·0	15·67	245·5	12·23	149·7
80	16·16	261·2	15·35	235·7	15·18	230·6	11·86	140·7
85	15·69	246·2	14·90	222·1	14·74	217·3	11·52	132·8
90	15·26	232·8	14·49	210·1	14·34	205·6	11·21	125·7
95	14·86	220·9	14·12	199·4	13·97	195·1	10·93	119·4
100	14·49	210·1	13·77	189·7	13·62	185·6	10·66	113·8
105	14·15	200·4	13·45	181·0	13·30	177·1	10·42	108·6
110	13·84	191·6	13·15	173·0	13·01	169·3	10·19	104·0
115	13·54	183·5	12·87	165·7	12·73	162·2	9·98	99·7
120	13·27	176·1	12·61	159·1	12·48	155·7	9·79	95·8
125	13·01	169·3	12·37	153·0	12·23	149·7	9·60	92·2
130	12·77	163·0	12·14	147·3	12·01	144·2	9·42	88·8
135	12·54	157·2	11·92	142·1	11·79	139·1	9·26	85·8
140	12·36	152·8	11·71	137·2	11·59	134·3	9·11	83·0
145	12·11	146·8	11·52	132·7	11·39	129·9	8·96	80·3
150	11·92	142·1	11·33	128·5	11·21	125·7	8·82	77·8
155	11·73	137·7	11·16	124·5	11·04	121·9	8·69	75·5
160	11·56	133·6	10·99	120·8	10·87	118·3	8·56	73·3
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate 1 inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...	20·46	418·8
75	...	...	...	...	...	...	20·96	439·5	19·78	391·3
80	...	...	...	...	...	...	20·30	412·4	19·16	367·2
85	...	...	...	...	20·76	431·0	19·71	388·5	18·60	346·0
90	...	...	...	...	20·18	407·3	19·16	367·2	18·08	327·1
95	...	...	...	...	19·65	386·2	18·66	348·2	17·61	310·2
100	...	...	...	...	19·16	367·2	18·19	331·1	17·17	295·0
105	...	...	...	...	18·71	350·0	17·76	315·6	16·77	281·2
110	...	...	...	...	18·28	334·4	17·36	301·5	16·39	268·7
115	...	...	...	...	17·89	320·1	16·99	288·7	16·04	257·3
120	...	...	...	...	17·52	307·0	16·64	276·9	15·71	246·8
125	...	...	...	...	17·17	295·0	16·31	266·1	15·40	237·2
130	...	...	20·56	422·8	16·85	283·8	16·00	256·0	15·11	228·3
135	20·83	434·1	20·18	407·3	16·54	273·5	15·71	246·8	14·83	220·0
140	20·46	418·8	19·82	393·0	16·25	264·0	15·43	238·2	14·57	212·4
145	20·11	404·6	19·48	379·7	15·97	255·1	15·17	230·2	14·32	205·3
150	19·78	391·3	19·16	367·2	15·71	246·8	14·92	222·7	14·09	198·6
155	19·46	378·9	18·85	355·5	15·46	239·0	14·68	215·7	13·87	192·4
160	19·16	367·2	18·56	344·6	15·22	231·7	14·46	209·2	13·66	186·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate 1 inch thick.

Pressure per sq. in.	$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	19·68	387·4
35	...	...	...	...	...	...	18·24	332·9
40	...	...	...	...	...	...	17·09	292·1
45	...	...	20·96	439·5	20·73	429·8	16·13	260·3
50	20·96	439·5	19·90	396·1	19·68	387·4	15·32	234·8
55	20·00	400·0	18·99	360·6	18·78	352·8	14·63	214·0
60	19·16	367·2	18·19	331·1	17·99	323·9	14·02	196·7
65	18·42	339·4	17·49	306·1	17·30	299·4	13·49	182·0
70	17·76	315·6	16·87	284·6	16·68	278·4	13·01	169·4
75	17·17	295·0	16·31	266·1	16·13	260·3	12·59	158·5
80	16·64	276·9	15·80	249·8	15·63	244·4	12·20	149·0
85	16·15	261·0	15·34	235·5	15·17	230·4	11·86	140·6
90	15·71	246·8	14·92	222·7	14·76	217·9	11·54	133·1
95	15·30	234·1	14·53	211·3	14·38	206·7	11·24	126·4
100	14·92	222·7	14·18	201·0	14·02	196·7	10·97	120·4
105	14·57	212·4	13·84	191·7	13·69	187·6	10·72	114·9
110	14·25	203·0	13·54	183·3	13·39	179·4	10·49	110·0
115	13·94	194·4	13·25	175·6	13·11	171·8	10·27	105·5
120	13·66	186·6	12·98	168·5	12·84	164·9	10·06	101·3
125	13·39	179·4	12·73	162·0	12·59	158·5	9·87	97·5
130	13·14	172·7	12·49	156·0	12·35	152·7	9·69	94·0
135	12·90	166·5	12·26	150·5	12·13	147·2	9·52	90·7
140	12·68	160·8	12·05	145·3	11·92	142·2	9·36	87·7
145	12·47	155·4	11·85	140·5	11·72	137·5	9·21	84·9
150	12·26	150·5	11·66	136·0	11·54	133·1	9·07	82·2
155	12·07	145·8	11·48	131·8	11·36	129·0	8·93	79·8
160	11·89	141·4	11·31	127·9	11·19	125·2	8·80	77·5
	$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...	21·06	443·5
75	...	...	...	...	...	...	...	...	20·35	414·3
80	...	...	...	...	...	...	20·89	436·6	19·71	388·8
85	...	...	...	...	...	...	20·28	411·3	19·13	366·2
90	...	...	...	...	20·76	431·3	19·71	388·8	18·60	346·2
95	...	...	...	...	20·22	408·9	19·20	368·6	18·12	328·3
100	...	...	...	...	19·71	388·8	18·72	350·5	17·67	312·2
105	...	...	...	...	19·25	370·5	18·28	334·1	17·25	297·6
110	...	...	...	...	18·81	354·0	17·86	319·2	16·86	284·4
115	...	...	...	...	18·40	338·8	17·48	305·5	16·50	272·3
120	...	...	...	...	18·02	325·0	17·12	293·1	16·16	261·2
125	...	...	...	...	17·67	312·2	16·78	281·6	15·84	251·0
130	...	...	...	...	17·33	300·4	16·46	271·0	15·54	241·5
135	...	...	20·76	431·3	17·01	289·5	16·16	261·2	15·26	232·8
140	...	...	20·40	416·1	16·71	279·4	15·87	252·0	14·99	224·7
145	20·69	428·4	20·05	402·0	16·43	270·0	15·60	243·6	14·73	217·2
150	20·35	414·3	19·71	388·8	16·16	261·2	15·35	235·6	14·49	210·1
155	20·03	401·1	19·40	376·4	15·90	252·9	15·10	228·2	14·26	203·5
160	19·71	388·8	19·10	364·8	15·66	245·2	14·87	221·3	14·05	197·4
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	20·25	410·2
35	...	...	...	...	...	...	18·77	352·5
40	...	...	...	...	...	...	17·58	309·1
45	...	...	...	...	...	...	16·59	275·5
50	...	...	20·48	419·4	20·25	410·2	15·76	248·5
55	20·58	423·6	19·54	381·8	19·32	373·5	15·05	226·5
60	19·71	388·8	18·72	350·5	18·51	342·8	14·42	208·1
65	18·95	359·3	18·00	324·0	17·80	316·9	13·87	192·5
70	18·28	334·1	17·35	301·3	17·16	294·7	13·38	179·2
75	17·67	312·2	16·78	281·6	16·59	275·5	12·95	167·7
80	17·12	293·1	16·26	264·3	16·08	258·6	12·55	157·5
85	16·62	276·2	15·78	249·1	15·61	243·7	12·19	148·6
90	16·16	261·2	15·35	235·6	15·18	230·5	11·86	140·7
95	15·74	247·7	14·95	223·5	14·79	218·7	11·56	133·6
100	15·35	235·6	14·58	212·7	14·42	208·1	11·28	127·2
105	14·99	224·7	14·24	202·8	14·09	198·5	11·02	121·5
110	14·65	214·8	13·92	193·9	13·77	189·7	10·78	116·2
115	14·34	205·7	13·63	185·7	13·48	181·7	10·55	111·4
120	14·05	197·4	13·35	178·2	13·20	174·4	10·34	107·0
125	13·77	189·7	13·09	171·3	12·95	167·7	10·15	103·0
130	13·51	182·6	12·84	165·0	12·70	161·4	9·96	99·2
135	13·27	176·1	12·61	159·1	12·47	155·7	9·79	95·8
140	13·04	170·0	12·39	153·6	12·26	150·3	9·62	92·6
145	12·82	164·4	12·18	148·5	12·05	145·3	9·46	89·6
150	12·61	159·1	11·99	143·8	11·86	140·7	9·32	86·8
155	12·41	154·1	11·80	139·3	11·68	136·4	9·17	84·2
160	12·23	149·5	11·62	135·1	11·50	132·3	9·04	81·7
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{16}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...	...	...
75	...	...	...	...	...	...	...	...	20·92	438·0
80	...	...	...	...	...	...	...	...	20·27	411·0
85	...	...	...	...	...	...	20·85	434·8	19·67	387·1
90	...	...	...	...	...	...	20·27	411·0	19·13	366·0
95	...	...	...	...	20·79	432·3	19·74	389·6	18·63	347·0
100	...	...	...	...	20·27	411·0	19·24	370·5	18·16	330·0
105	...	...	...	...	19·79	391·7	18·79	353·1	17·73	314·5
110	...	...	...	...	19·34	374·1	18·36	337·3	17·33	300·5
115	...	...	...	...	18·92	358·1	17·97	322·9	16·96	287·7
120	...	...	...	...	18·53	343·5	17·60	309·7	16·61	276·0
125	...	...	...	...	18·16	330·0	17·25	297·6	16·28	265·2
130	...	...	...	...	17·82	317·5	16·92	286·3	15·97	255·2
135	...	...	...	...	17·49	306·0	16·61	276·0	15·68	246·0
140	...	...	20·97	439·9	17·18	295·2	16·32	266·3	15·40	237·4
145	...	...	20·61	424·9	16·89	285·3	16·04	257·3	15·14	229·4
150	20·92	438·0	20·27	411·0	16·61	276·0	15·78	249·0	14·90	222·0
155	20·59	424·0	19·94	397·9	16·35	267·2	15·53	241·1	14·66	215·0
160	20·27	411·0	19·63	385·6	16·09	259·1	15·29	233·8	14·44	208·5
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

TABLE No. 107 *continued.*

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{16}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	20·82	433·6
35	...	...	...	...	...	...	19·30	372·5
40	...	...	...	...	...	...	18·07	326·7
45	...	...	...	...	...	...	17·06	291·1
50	...	...	21·05	443·4	20·82	433·6	16·20	262·6
55	...	...	20·09	403·6	19·87	394·8	15·46	239·2
60	20·27	411·0	19·24	370·5	19·03	362·4	14·82	219·8
65	19·49	379·8	18·50	342·4	18·30	334·9	14·26	203·3
70	18·79	353·1	17·84	318·4	17·64	311·4	13·75	189·2
75	18·16	330·0	17·25	297·6	17·06	291·1	13·30	177·0
80	17·60	309·7	16·68	278·2	16·53	273·3	12·89	166·3
85	17·08	291·8	16·22	263·2	16·05	257·5	12·52	156·9
90	16·61	276·0	15·78	249·0	15·60	243·6	12·18	148·5
95	16·18	261·7	15·37	236·2	15·20	231·0	11·87	141·0
100	15·78	249·0	14·99	224·7	14·82	219·8	11·58	134·3
105	15·40	237·4	14·63	214·2	14·48	209·6	11·32	128·1
110	15·06	226·9	14·31	204·8	14·15	200·4	11·07	122·6
115	14·74	217·3	14·00	196·0	13·85	191·9	10·84	117·5
120	14·44	208·5	13·72	188·2	13·57	184·2	10·62	112·9
125	14·15	200·4	13·45	180·9	13·30	177·0	10·42	108·6
130	13·89	192·9	13·20	174·2	13·05	170·4	10·23	104·6
135	13·63	186·0	12·96	168·0	12·82	164·4	10·05	101·0
140	13·40	179·5	12·73	162·2	12·60	158·7	9·88	97·6
145	13·17	173·5	12·52	156·8	12·38	153·4	9·72	94·4
150	12·96	168·0	12·32	151·8	12·18	148·5	9·56	91·5
155	12·75	162·7	12·12	147·0	11·99	143·9	9·42	88·7
160	12·56	157·8	11·94	142·6	11·81	139·6	9·28	86·1
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{3}{32}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...	...	...
75	...	...	...	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...	...	20·82	433·8
85	...	...	...	...	...	...	...	...	20·21	408·6
90	...	...	...	...	...	...	20·82	433·8	19·65	386·2
95	...	...	...	...	...	...	20·28	411·2	19·13	366·2
100	...	...	...	...	20·82	433·8	19·77	391·0	18·66	348·2
105	...	...	...	...	20·33	413·4	19·30	372·6	18·22	331·9
110	...	...	...	...	19·87	394·9	18·86	356·0	17·80	317·1
115	...	...	...	...	19·44	378·0	18·46	340·8	17·42	303·6
120	...	...	...	...	19·04	362·5	18·08	326·8	17·06	291·2
125	...	...	...	...	18·66	348·2	17·72	314·0	16·72	279·8
130	...	...	...	...	18·30	335·0	17·38	302·1	16·41	269·2
135	...	...	...	...	17·96	322·8	17·06	291·2	16·11	259·5
140	...	...	...	...	17·65	311·5	16·76	281·0	15·82	250·4
145	...	...	...	...	17·35	301·0	16·47	271·5	15·55	242·0
150	...	...	20·82	433·8	17·06	291·2	16·20	262·6	15·30	234·1
155	...	...	20·49	420·0	16·79	282·0	15·95	254·4	15·06	226·8
160	...	...	20·17	407·0	16·53	273·3	15·70	246·6	14·83	219·9
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{3}{32}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	19·83	393·2
40	...	...	...	...	...	...	18·57	344·8
45	...	...	...	...	...	...	17·52	307·1
50	...	...	...	...	...	...	16·64	277·0
55	...	...	20·64	426·0	20·41	416·7	15·88	252·4
60	20·82	433·8	19·77	391·0	19·55	382·4	15·22	231·8
65	20·02	400·9	19·01	361·4	18·80	353·5	14·64	214·5
70	19·30	372·6	18·33	336·0	18·13	328·6	14·12	199·6
75	18·66	348·2	17·72	314·0	17·52	307·1	13·66	186·7
80	18·08	326·8	17·16	294·7	16·98	288·3	13·24	175·4
85	17·55	307·9	16·66	277·7	16·48	271·7	12·86	165·4
90	17·06	291·2	16·20	262·6	16·03	256·9	12·51	156·5
95	16·62	276·1	15·78	249·1	15·61	243·7	12·19	148·6
100	16·20	262·6	15·39	237·0	15·22	231·8	11·89	141·5
105	15·82	250·4	15·03	226·0	14·87	221·1	11·62	135·0
110	15·47	239·3	14·69	216·0	14·53	211·3	11·36	129·2
115	15·14	229·2	14·38	206·8	14·22	202·4	11·12	123·8
120	14·83	219·9	14·09	198·5	13·93	194·2	10·90	118·9
125	14·53	211·3	13·81	190·8	13·66	186·7	10·69	114·4
130	14·26	203·4	13·55	183·7	13·40	179·7	10·50	110·2
135	14·00	196·0	13·30	177·1	13·16	173·3	10·31	106·3
140	13·76	189·3	13·07	171·0	12·93	167·3	10·14	102·8
145	13·52	183·0	12·85	165·3	12·72	161·7	9·97	99·4
150	13·30	177·1	12·65	160·0	12·51	156·5	9·81	96·3
155	13·10	171·6	12·45	155·0	12·31	151·7	9·66	93·4
160	12·90	166·4	12·26	150·3	12·13	147·1	9·52	90·7
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{8}$ inch thick.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...	...	...
75	...	...	...	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...	...	...	...
85	...	...	...	...	...	...	...	...	20·75	430·7
90	...	...	...	...	...	...	...	...	20·17	407·1
95	...	...	...	...	...	...	20·82	433·5	19·64	386·0
100	...	...	...	...	...	...	20·30	412·1	19·15	367·0
105	...	...	...	...	20·87	435·7	19·81	392·7	18·70	349·8
110	...	...	...	...	20·40	416·2	19·37	375·2	18·28	334·1
115	...	...	...	...	19·96	398·3	18·95	359·1	17·88	319·9
120	...	...	...	...	19·54	382·0	18·55	344·4	17·51	306·8
125	...	...	...	...	19·15	367·0	18·19	330·9	17·17	294·8
130	...	...	...	...	18·79	353·1	17·84	318·4	16·84	283·6
135	...	...	...	...	18·44	340·2	17·51	306·8	16·53	273·4
140	...	...	...	...	18·12	328·3	17·20	296·0	16·24	263·8
145	...	...	...	...	17·81	317·2	16·91	286·0	15·96	254·9
150	...	...	...	...	17·51	306·8	16·63	276·7	15·70	246·6
155	...	...	...	...	17·23	297·1	16·37	268·0	15·45	238·9
160	...	...	20·71	429·0	16·97	288·0	16·12	259·8	15·22	231·6
	*A_1		*B_1		*C_1		*D_1		*E_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{8}$ inch thick.

Pressure per sq. in.	*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	20·35	414·4
40	...	...	...	...	...	...	19·06	363·3
45	...	...	...	...	...	...	17·99	323·6
50	...	...	...	...	...	...	17·08	291·9
55	...	...	...	...	20·95	439·2	16·30	265·9
60	...	...	20·30	412·1	20·07	403·1	15·62	244·2
65	20·55	422·5	19·51	380·8	19·30	372·5	15·03	225·9
70	19·81	392·7	18·81	354·1	18·61	346·3	14·50	210·2
75	19·15	367·0	18·19	330·9	17·99	323·6	14·02	196·6
80	18·55	344·4	17·62	310·5	17·43	303·8	13·59	184·6
85	18·01	324·5	17·10	292·6	16·92	286·3	13·19	174·1
90	17·51	306·8	16·63	276·7	16·45	270·7	12·84	164·8
95	17·05	291·0	16·20	262·5	16·02	256·8	12·51	156·4
100	16·63	276·7	15·80	249·6	15·62	244·2	12·20	148·9
105	16·24	263·8	15·43	238·0	15·26	232·9	11·92	142·1
110	15·87	252·1	15·08	227·5	14·92	222·6	11·66	135·9
115	15·53	241·4	14·76	217·8	14·60	213·1	11·41	130·3
120	15·22	231·6	14·45	209·0	14·30	204·5	11·18	125·1
125	14·92	222·6	14·17	200·9	14·02	196·6	10·97	120·3
130	14·63	214·2	13·90	193·4	13·75	189·2	10·76	115·9
135	14·37	206·5	13·65	186·5	13·50	182·4	10·57	111·8
140	14·12	199·3	13·42	180·0	13·27	176·1	10·39	108·1
145	13·88	192·7	13·19	174·0	13·05	170·3	10·22	104·5
150	13·65	186·5	12·97	168·4	12·84	164·8	10·06	101·3
155	13·44	180·6	12·77	163·2	12·63	159·7	9·91	98·2
160	13·23	175·2	12·58	158·2	12·44	154·9	9·76	95·3
	*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found immediately preceding these Tables.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on *solid* STEEL screwed Stays which have *not* been welded or worked in the fire 9000 lbs. per square inch of net section.

The following notes will facilitate the use of the Tables which immediately follow, numbered 110 to 114 and Nos. 315 to 317.

(1) If the working pressure be 150 lbs., the surface to be supported by one stay 252 square inches, and the size of stay be required:—

Then, opposite 150 lbs. in Table No. 113, the surface, 252 square inches, is found under the diameter $2\frac{5}{16}$ inches, and area 4·2 square inches, which is the size of stay required.

(2) If the surface be 160 square inches, the stay $1\frac{7}{8}$ inch diameter, area 2·7612 square inches, and working pressure be required:—

Then, in Table No. 112, $1\frac{7}{8}$ inch diameter stay is found, and in the column under the area 2·7612 square inches and $1\frac{7}{8}$ inch diameter, the surface is 160·3 square inches, and opposite it the pressure is 155 lbs., which is the working pressure suitable.

(3) If the stay be 1 inch diameter, the area ·7854 square inch, and the working pressure is to be 80 lbs., and the greatest surface for such size of stay and working pressure be required:—

Then, in Table No. 110, 1 inch stay is found, and opposite 80 lbs. in the column for 1 inch diameter, area ·7854 inch, the surface is 88·3 square inches, which is the surface suitable for such stay and pressure.

When the surface is not found opposite the pressure, it will be on the side of safety to adopt the larger size of stay, over the next greater surface on the right.

The diameter is always the net effective diameter, or diameter at the bottom of the thread, and the area the net sectional area at the smallest part of the stay.

Stress on *solid* Steel screwed Stays, which have *not* been welded or worked in the fire, 9000 lbs. per square inch of net section.*

Pressure per square inch.	Area 0·1963 sq. in. Diam. ½ inch.	Area 0·2485 sq. in. Diam. 9/16 inch.	Area 0·3068 sq. in. Diam. ⅝ inch.	Area 0·3712 sq. in. Diam. 11/16 inch.	Area 0·4417 sq. in. Diam. ¾ inch.	Area 0·5184 sq. in. Diam. 13/16 inch.	Area 0·6013 sq. in. Diam. ⅞ inch.	Area 0·6902 sq. in. Diam. 15/16 inch.	Area 0·7854 sq. in. Diam. 1 inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	353·3	447·3	552·2	668·1	795·0	933·1	...	...	...
10	176·6	223·6	276·1	334·0	397·5	466·5	541·1	621·1	706·8
15	117·7	149·1	184·0	222·7	265·0	311·0	360·7	414·1	471·2
20	88·3	111·8	138·0	167·0	198·7	233·2	270·5	310·5	353·4
25	70·6	89·4	110·4	133·6	159·0	186·6	216·4	248·4	282·7
30	58·8	74·5	92·0	111·3	132·5	155·5	180·3	207·0	235·6
35	50·4	63·9	78·8	95·4	113·5	133·3	154·6	177·4	201·9
40	44·1	55·9	69·0	83·5	99·3	116·6	135·2	155·2	176·7
45	39·2	49·7	61·3	74·2	88·3	103·6	120·2	138·0	157·0
50	35·3	44·7	55·2	66·8	79·5	93·3	108·2	124·2	141·2
55	32·1	40·6	50·2	60·7	72·2	84·8	98·3	112·9	128·5
60	29·4	37·2	46·0	55·6	66·2	77·7	90·1	103·5	117·8
65	27·1	34·4	42·4	51·3	61·1	71·7	83·2	95·5	108·7
70	25·2	31·9	39·4	47·7	56·7	66·6	77·3	88·7	100·9
75	23·5	29·8	36·8	44·5	53·0	62·2	72·1	82·8	94·2
80	22·0	27·9	34·5	41·7	49·6	58·3	67·6	77·6	88·3
85	20·7	26·3	32·4	39·3	46·7	54·9	63·6	73·0	83·1
90	19·6	24·8	30·6	37·1	44·1	51·8	60·1	69·0	78·5
95	18·5	23·5	29·0	35·1	41·8	49·1	56·9	65·3	74·4
100	17·6	22·3	27·6	33·4	39·7	46·6	54·1	62·1	70·6
105	16·8	21·3	26·2	31·8	37·8	44·4	51·5	59·1	67·3
110	16·0	20·3	25·0	30·3	36·1	42·4	49·1	56·4	64·2
115	15·3	19·4	24·0	29·0	34·5	40·5	47·0	54·0	61·4
120	14·7	18·6	23·0	27·8	33·1	38·8	45·0	51·7	58·9
125	14·1	17·8	22·0	26·7	31·8	37·3	43·2	49·7	56·5
130	13·5	17·2	21·2	25·6	30·5	35·8	41·6	47·7	54·3
135	13·0	16·5	20·4	24·7	29·4	34·5	40·0	46·0	52·3
140	12·6	15·9	19·7	23·8	28·3	33·3	38·6	44·3	50·4
145	...	15·4	19·0	23·0	27·4	32·1	37·3	42·8	48·7
150	...	14·9	18·4	22·2	26·5	31·1	36·0	41·4	47·1
155	...	14·4	17·8	21·5	25·6	30·1	34·9	40·0	45·6
160	...	13·9	17·2	20·8	24·8	29·6	33·8	38·8	44·1

* 9000 lbs. per square inch of net section is the greatest working stress to which *solid* steel screwed stays should be subjected. Steel stays which have been welded or worked in the fire are *not* reliable, and should *not* be used.

PRESSURES, GREATEST SURFACES, AND SIZES OF STAYS.

TABLE No. 111.

Stress on *solid* Steel screwed Stays, which have *not* been welded or worked in the fire, 9000 lbs. per square inch of net section.*

Pressure per square inch.	Area 0·8866 sq. in. Diam. $1\frac{1}{16}$ inch.	Area 0·9940 sq. in. Diam. $1\frac{1}{8}$ inch.	Area 1·1075 sq. in. Diam. $1\frac{3}{16}$ inch.	Area 1·2272 sq. in. Diam. $1\frac{1}{4}$ inch.	Area 1·3530 sq. in. Diam. $1\frac{5}{16}$ inch.	Area 1·4849 sq. in. Diam. $1\frac{3}{8}$ inch.	Area 1·6230 sq. in. Diam. $1\frac{7}{16}$ inch.	Area 1·7671 sq. in. Diam. $1\frac{1}{2}$ inch.	Area 1·9175 sq. in. Diam. $1\frac{9}{16}$ inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	797·9	894·6	996·7	...	...	...	...	...	...
15	531·9	596·4	664·5	736·3	811·8	890·9	973·8	...	...
20	398·9	447·3	498·3	552·2	608·9	668·2	730·3	795·1	862·8
25	319·1	357·8	398·7	441·7	487·0	534·5	584·2	636·1	690·3
30	265·9	298·2	332·2	368·1	405·9	445·4	486·9	530·1	575·2
35	227·9	255·6	284·7	315·5	347·9	381·8	417·3	454·3	493·0
40	199·4	223·6	249·1	276·1	304·4	334·1	365·1	397·5	431·4
45	177·3	198·8	221·5	245·4	270·6	296·9	324·6	353·4	383·5
50	159·5	178·9	199·3	220·8	243·5	267·2	292·1	318·0	345·1
55	145·0	162·6	181·2	200·8	221·4	242·9	265·5	289·1	313·7
60	132·9	149·1	166·1	184·0	202·9	222·7	243·4	265·0	287·6
65	122·7	137·6	153·3	169·9	187·3	205·6	224·7	244·6	265·5
70	113·9	127·8	142·3	157·7	173·9	190·9	208·6	227·1	246·5
75	106·3	119·2	132·9	147·2	162·3	178·1	194·7	212·0	230·1
80	99·7	111·8	124·5	138·0	152·2	167·0	182·5	198·7	215·7
85	93·8	105·2	117·2	129·9	143·2	157·2	171·8	187·1	203·0
90	88·6	99·4	110·7	122·7	135·3	148·4	162·3	176·7	191·7
95	83·9	94·1	104·9	116·2	128·1	140·6	153·7	167·4	181·6
100	79·7	89·4	99·6	110·4	121·7	133·6	146·0	159·0	172·5
105	75·9	85·2	94·9	105·1	115·9	127·2	139·1	151·4	164·3
110	72·5	81·3	90·6	100·4	110·7	121·4	132·7	144·5	156·8
115	69·3	77·7	86·6	96·0	105·8	116·2	127·0	138·2	150·0
120	66·4	74·5	83·0	92·0	101·4	111·3	121·7	132·5	143·8
125	63·8	71·5	79·7	88·3	97·4	106·9	116·8	127·2	138·0
130	61·3	68·8	76·6	84·9	93·6	102·8	112·3	122·3	132·7
135	59·1	66·2	73·8	81·8	90·2	98·9	108·2	117·8	127·8
140	56·9	63·9	71·1	78·8	86·9	95·4	104·3	113·5	123·2
145	55·0	61·6	68·7	76·1	83·9	92·1	100·7	109·6	119·0
150	50·1	59·6	66·4	73·6	81·1	89·0	97·3	106·0	115·0
155	51·4	57·7	64·3	71·2	78·5	86·2	94·2	102·6	111·3
160	49·8	55·9	62·2	69·0	76·1	83·5	91·2	99·3	107·8

* 9000 lbs. per square inch of net section is the greatest working stress to which *solid* steel screwed stays should be subjected. Steel stays which have been welded or worked in the fire are *not* reliable, and should *not* be used.

Stress on *Solid* Steel Screwed Stays, which have *not* been welded or worked in the fire, 9000 lbs. per square inch of net section.*

Pressure per square inch.	Area 2·0739 sq. ins.	Area 2·2365 sq. ins.	Area 2·4053 sq. ins.	Area 2·5802 sq. ins.	Area 2·7612 sq. ins.	Area 2·9483 sq. ins.	Area 3·1416 sq. ins.	Area 3·3410 sq. ins.	Area 3·5466 sq. ins.
	Diam. 1⅝ inch.	Diam. 1 11/16 inch.	Diam. 1¾ inch.	Diam. 1 13/16 inch.	Diam. 1⅞ inch.	Diam. 1 15/16 inch.	Diam. 2 inches.	Diam. 2 1/16 inches.	Diam. 2⅛ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	933·2	...	...	...	...	...	...	...	...
25	746·6	805·1	865·9	928·8	994·0	...	...	...	...
30	622·1	670·9	721·5	774·0	828·3	884·4	942·4	...	...
35	533·2	575·1	618·5	663·4	710·0	758·1	807·8	859·1	911·9
40	466·6	503·2	541·1	580·5	621·2	663·3	706·8	751·7	797·9
45	414·7	447·3	481·0	516·0	552·2	589·6	628·3	668·2	709·3
50	373·3	402·5	432·9	464·4	497·0	530·6	565·4	601·3	638·3
55	339·3	365·9	393·5	422·2	451·8	482·4	514·0	546·7	580·3
60	311·0	335·4	360·7	387·0	414·1	442·2	471·2	501·1	531·9
65	287·1	309·6	333·0	357·2	382·3	408·2	434·9	462·6	491·0
70	266·6	287·5	309·2	331·7	355·0	379·0	403·9	429·5	455·9
75	248·8	268·3	288·6	309·6	331·3	353·7	376·9	400·9	425·5
80	233·3	251·6	270·5	290·2	310·6	331·6	353·4	375·8	398·9
85	219·5	236·8	254·6	273·1	292·3	312·1	332·6	353·7	375·5
90	207·3	223·6	240·5	258·0	276·1	294·8	314·1	334·1	354·6
95	196·4	211·8	227·8	244·4	261·5	279·3	297·6	316·5	335·9
100	186·6	201·2	216·4	232·2	248·5	265·3	282·7	300·6	319·1
105	177·7	191·7	206·1	221·1	236·6	252·7	269·2	286·3	303·9
110	169·6	182·9	196·7	211·0	225·9	241·2	257·0	273·3	290·1
115	162·3	175·0	188·2	201·9	216·0	230·7	245·8	261·4	277·5
120	155·5	167·7	180·3	193·5	207·0	221·1	235·6	250·5	265·9
125	149·3	161·0	173·1	185·7	198·8	212·2	226·1	240·5	255·3
130	143·5	154·8	166·5	178·6	191·1	204·1	217·4	231·3	245·5
135	138·2	149·1	160·3	172·0	184·0	196·5	209·4	222·7	236·4
140	133·3	143·7	154·6	165·8	177·5	189·5	201·9	214·7	227·9
145	128·7	138·8	149·2	160·1	171·3	182·9	194·9	207·3	220·1
150	124·4	134·1	144·3	154·8	165·6	176·8	188·4	200·4	212·7
155	120·4	129·8	139·6	149·8	160·3	171·1	182·4	193·9	205·9
160	116·6	125·8	135·2	145·1	155·3	165·8	176·7	187·9	199·4

* 9000 lbs. per square inch of net section is the greatest working stress to which *solid* steel screwed stays should be subjected. Steel stays which have been welded or worked in the fire are *not* reliable and should *not* be used.

Stress on *Solid* Steel Screwed Stays, which have *not* been welded or worked in the fire, 9000 lbs. per square inch of net section.*

Pressure per square inch.	Area 3·7583 sq. ins.	Area 3·9761 sq. ins.	Area 4·2000 sq. ins.	Area 4·4301 sq. ins.	Area 4·6664 sq. ins.	Area 4·9087 sq. ins.	Area 5·1572 sq. ins.	Area 5·4119 sq. ins.	Area 5·6727 sq. ins.
	Diam. $2\frac{3}{16}$ inches.	Diam. $2\frac{1}{4}$ inches.	Diam. $2\frac{5}{16}$ inches.	Diam. $2\frac{3}{8}$ inches.	Diam. $2\frac{7}{16}$ inches.	Diam. $2\frac{1}{2}$ inches.	Diam. $2\frac{9}{16}$ inches.	Diam. $2\frac{5}{8}$ inches.	Diam. $2\frac{11}{16}$ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...
35	966·4	...	...	...	...	...	...	...	...
40	845·6	894·6	945·0	996·7	...	...	...	...	...
45	751·6	795·2	840·0	886·0	933·2	981·7	...	...	...
50	676·4	715·6	756·0	797·4	839·9	883·5	928·2	974·1	...
55	614·9	650·6	687·2	724·9	763·5	803·2	843·9	885·5	928·2
60	563·7	596·4	630·0	664·5	699·9	736·3	773·5	811·7	850·9
65	520·3	550·5	581·5	613·4	646·1	679·6	714·0	749·3	785·4
70	483·2	511·2	540·0	569·5	599·9	631·1	663·0	695·8	729·3
75	450·9	477·1	504·0	531·6	559·9	589·0	618·8	649·4	680·7
80	422·8	447·3	472·5	498·3	524·9	552·2	580·1	608·8	638·1
85	397·9	421·0	444·7	469·0	494·0	519·7	546·0	573·0	600·6
90	375·8	397·6	420·0	443·0	466·6	490·8	515·7	541·1	567·2
95	356·0	376·6	397·9	419·7	442·0	465·0	488·5	512·7	537·4
100	338·2	357·8	378·0	398·7	419·9	441·7	464·1	487·0	510·5
105	322·1	340·8	360·0	379·7	399·9	420·7	442·0	463·8	486·2
110	307·4	325·3	343·6	362·4	381·7	401·6	421·9	442·7	464·1
115	294·1	311·1	328·7	346·7	365·1	384·1	403·6	423·5	443·9
120	281·8	298·2	315·0	332·2	349·9	368·1	386·7	405·8	425·4
125	270·5	286·2	302·4	318·9	335·9	353·4	371·3	389·6	408·4
130	260·1	275·2	290·7	306·7	323·0	339·8	357·0	374·6	392·7
135	250·5	265·0	280·0	295·3	311·0	327·2	343·8	360·7	378·1
140	241·6	255·6	270·0	284·7	299·9	315·5	331·5	347·9	364·6
145	233·2	246·7	260·6	274·9	289·6	304·6	320·1	335·9	352·0
150	225·4	238·5	252·0	265·8	279·9	294·5	309·4	324·7	340·3
155	218·2	230·8	243·8	257·2	270·9	285·0	299·4	314·2	329·3
160	211·3	223·6	236·2	249·1	262·4	276·1	290·0	304·4	319·0

* 9000 lbs. per square inch of net section is the greatest working stress to which *solid* steel screwed stays should be subjected. Steel stays which have been welded or worked in the fire are *not* reliable and should *not* be used.

Stress on *Solid* Steel Screwed Stays, which have *not* been welded or worked in the fire, 9000 lbs. per square inch of net section.*

Pressure per square inch.	Area 5·9396 sq. ins.	Area 6·2126 sq. ins.	Area 6·4918 sq. ins.	Area 6·7771 sq. ins.	Area 7·0686 sq. ins.	Area 7·3662 sq. ins.	Area 7·6699 sq. ins.	Area 7·9798 sq. ins.	Area 8·2958 sq. ins.
	Diam. 2¾ inches.	Diam. 2 13/16 inches.	Diam. 2⅞ inches.	Diam. 2 15/16 inches.	Diam. 3 inches.	Diam. 3 1/16 inches.	Diam. 3⅛ inches.	Diam. 3 3/16 inches.	Diam. 3¼ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...	...
55	971·9	...	...	...	...	...	...	...	...
60	890·9	931·8	973·7	...	...	...	...	...	...
65	822·4	860·2	898·8	938·3	978·7	...	...	...	...
70	763·6	798·7	834·6	871·3	908·8	947·0	986·1	...	...
75	712·7	745·5	779·0	813·2	848·2	883·9	920·3	957·5	995·4
80	668·2	698·9	730·3	762·4	795·2	828·6	862·8	897·7	933·2
85	628·8	657·8	687·3	717·5	748·4	779·9	812·1	844·9	878·3
90	593·9	621·2	649·1	677·7	706·8	736·6	766·9	797·9	829·5
95	562·6	588·5	615·0	642·0	669·6	697·8	726·6	755·9	785·9
100	534·5	559·1	584·2	609·9	636·1	662·9	690·2	718·1	746·6
105	509·1	532·5	556·4	580·9	605·8	631·3	657·4	683·9	711·0
110	485·9	508·3	531·1	554·4	578·3	602·6	627·5	652·8	678·7
115	464·8	486·2	508·0	530·3	553·1	576·4	600·2	624·5	649·2
120	445·4	465·9	486·8	508·2	530·1	552·4	575·2	598·4	622·1
125	427·6	447·3	467·4	487·9	508·9	530·3	552·2	574·5	597·2
130	411·2	430·1	449·4	469·1	489·3	509·9	530·9	552·4	574·3
135	395·9	414·1	432·7	451·8	471·2	491·0	511·3	531·9	553·0
140	381·8	399·3	417·3	435·6	454·4	473·5	493·0	512·9	533·3
145	368·6	385·6	402·9	420·6	438·7	457·2	476·0	495·2	514·9
150	356·3	372·7	389·5	406·6	424·1	441·9	460·1	478·7	497·7
155	344·8	360·7	376·9	393·5	410·4	427·7	445·3	463·3	481·6
160	334·0	349·4	365·1	381·2	397·6	414·3	431·4	448·8	466·6

* 9000 lbs. per square inch of net section is the greatest working stress to which *solid* steel screwed stays should be subjected. Steel stays which have been welded or worked in the fire are *not* reliable and should *not* be used.

STEEL GIRDERS FOR FLAT SURFACES.

The following notes will facilitate the use of the Tables numbered from 115 to 125, which immediately follow, and Nos. 318 to 328.

W = Width of combustion box, in inches.
D = Distance between centres of girders, in inches.
P = Pitch of supporting bolts, in inches.
N = Number of supporting bolts in a girder.

When the number of supporting bolts in a girder is *odd*, the number in the table under the particular depth of girder is the maximum value that $W^2 \times D$ may have for the particular working pressure opposite to it in column 1.

When the number of supporting bolts in a girder is *even*, the number in the table under the particular depth of girder is the maximum value that $(W^2 - P^2)D$ may have for the particular working pressure opposite to it in column 1.

(1) If the working pressure is required when the width of the box, the distance between centres of girders, the pitch of supporting bolts, the number of supporting bolts in the girder, and the dimensions of girder are known.

If the width, W, of the combustion box be 28 inches, the number, N, of the bolts 3 (which is an *odd* number), the distance, D, between the centres of the girders 7 inches, and the dimensions of the girder 6 inches deep by 1 inch thick :—

Then, $W^2 \times D$ or $28^2 \times 7 = 5488$. This number is not found in the table, as it is between 5280 and 5590 (see Table No. 119 for steel plates 1 inch thick), but by the note at the foot of the tables when the exact number is not found, the next *higher* number should be taken, and the pressure opposite 5590, the next *higher* number being 85 lbs., is the working pressure obtained; although, should the difference be very little over the lower number, such lower number may be used, and the pressure opposite it taken.

(2) When the depth of girder necessary for a given working pressure and thickness of girder is required :—

If the width, W, of the combustion box be 24 inches, the number, N, of supporting bolts 2 (which is an *even* number), the distance, D, between the centres of the girders $8\frac{3}{4}$ inches, the pitch of the supporting bolts 8 inches, the thickness of the girders 1 inch, and the working pressure 80 lbs. :—

Then, $(W^2 - P^2)D$ or $(24^2 - 8^2)8\frac{3}{4} = 4480$, and opposite 80 lbs. the working pressure in column 1, the number 4547 is found (see Table No. 119 for steel plates 1 inch thick), which is the next *greater* number to 4480, and at the head of column over 4547 will be found $5\frac{1}{4}$ inches, the depth of girder necessary.

P may in all cases be found by dividing W, the width of the combustion box, by N, the number of supporting bolts in the girder, *plus* 1, or

$$\frac{W}{N+1} \quad = \quad P \text{ in all cases.}$$

D, when the number of supporting bolts is *odd*, may be found by dividing the number in the table opposite the given working pressure by W^2.

When the number of supporting bolts is *even*, D can be found by dividing the number in the table opposite the given working pressure by $W^2 - P^2$.

The working pressure and thickness of plate regulate P, the pitch, and D, the distance between the centres of girders and the surface due to $P \times D$, should be regulated by the Tables for Steel Plates (Pitches, Surfaces, and Pressures). The girders should be proportioned so as to be effective for the pressure, pitch of supporting bolts, number of supporting bolts in a girder, and the distance between the centres of girders. By the following tables the dimensions of steel girders can be fixed, or the working pressure suitable for any given mild rolled steel plate girder ascertained.

The thicknesses in the Tables are the total thicknesses whether the girders be solid or formed of two plates.

Pressure per sq. in.	Depths of Girders in inches.								
	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
lbs. 5	4042	5280	6682	8250	9982	11880	13942	16170	18562
10	2021	2640	3341	4125	4991	5940	6971	8085	9281
15	1347	1760	2227	2750	3327	3960	4647	5390	6187
20	1010	1320	1670	2062	2495	2970	3485	4042	4640
25	808	1056	1336	1650	1996	2376	2788	3234	3712
30	673	880	1113	1375	1663	1980	2323	2695	3093
35	577	754	954	1178	1426	1697	1991	2310	2651
40	505	660	835	1031	1247	1485	1742	2021	2320
45	...	586	742	916	1109	1320	1549	1796	2062
50	...	528	668	825	998	1188	1394	1617	1856
55	...	...	607	750	907	1080	1267	1470	1687
60	...	...	556	687	831	990	1161	1347	1546
65	...	...	514	634	767	913	1072	1243	1427
70	...	...	...	589	713	848	995	1155	1325
75	...	...	...	550	665	792	929	1078	1237
80	...	...	...	515	623	742	871	1010	1160
85	...	...	...	...	587	698	820	951	1091
90	...	...	...	...	554	660	774	898	1031
95	...	...	...	...	525	625	733	851	976
100	...	...	...	...	...	594	697	808	928
105	...	...	...	...	...	565	663	770	883
110	...	...	...	...	...	540	633	735	843
115	...	...	...	...	...	516	606	703	807
120	...	...	...	...	...	...	580	673	773
125	...	...	...	...	...	...	557	646	742
130	...	...	...	...	...	...	536	621	713
135	...	...	...	...	...	...	516	598	687
140	...	...	...	...	...	...	...	577	662
145	...	...	...	...	...	...	...	557	640
150	...	...	...	...	...	...	...	539	618
155	...	...	...	...	...	...	...	521	598
160	...	...	...	...	...	...	...	505	580

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼
lbs.									
5	8353	10312	12478	14850	17428	20212	23203	26400	29803
10	4176	5156	6239	7425	8714	10106	11601	13200	14901
15	2784	3437	4159	4950	5809	6737	7734	8800	9934
20	2088	2578	3119	3712	4357	5053	5800	6600	7450
25	1670	2062	2495	2970	3485	4042	4640	5280	5960
30	1392	1718	2079	2475	2904	3368	3867	4400	4967
35	1193	1473	1782	2121	2489	2887	3314	3771	4257
40	1044	1289	1559	1856	2178	2526	2900	3300	3725
45	928	1145	1386	1650	1936	2245	2578	2933	3311
50	835	1031	1247	1485	1742	2021	2320	2640	2980
55	759	937	1134	1350	1584	1837	2109	2400	2709
60	696	859	1039	1237	1452	1684	1933	2200	2483
65	642	793	959	1142	1340	1554	1784	2030	2292
70	596	736	891	1060	1244	1443	1657	1885	2128
75	556	687	831	990	1161	1347	1546	1760	1986
80	522	644	779	928	1089	1263	1450	1650	1862
85	...	606	734	873	1025	1188	1364	1552	1753
90	...	572	693	825	968	1122	1289	1466	1655
95	...	542	656	781	917	1063	1221	1389	1568
100	...	515	623	742	871	1010	1160	1320	1490
105	...	...	594	707	829	962	1104	1257	1419
110	...	...	567	675	792	918	1054	1200	1354
115	...	...	542	645	757	878	1008	1147	1295
120	...	...	519	618	726	842	966	1100	1241
125	...	...	...	594	697	808	928	1056	1192
130	...	...	...	571	670	777	892	1015	1146
135	...	...	...	550	645	748	859	977	1103
140	...	...	...	530	622	721	828	942	1064
145	...	...	...	512	600	696	800	910	1027
150	...	...	...	...	580	673	773	880	993
155	...	...	...	...	562	652	748	851	961
160	...	...	...	...	544	631	725	825	931

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾
lbs. 5	14973	17820	20913	24255	27843	31680	35763	40095	44673
10	7486	8910	10456	12127	13921	15840	17881	20047	22336
15	4991	5940	6971	8085	9281	10560	11921	13365	14891
20	3743	4455	5228	6063	6960	7920	8940	10023	11168
25	2994	3564	4182	4851	5568	6336	7152	8019	8934
30	2495	2970	3485	4042	4640	5280	5960	6682	7445
35	2139	2545	2987	3465	3977	4525	5109	5727	6381
40	1871	2227	2614	3031	3480	3960	4470	5011	5584
45	1663	1980	2323	2695	3093	3520	3973	4455	4963
50	1497	1782	2091	2425	2784	3168	3576	4009	4467
55	1361	1620	1901	2205	2531	2880	3251	3645	4061
60	1247	1485	1742	2021	2320	2640	2980	3341	3722
65	1151	1370	1608	1865	2141	2436	2751	3084	3436
70	1069	1272	1493	1732	1988	2262	2554	2863	3190
75	998	1188	1394	1617	1856	2112	2384	2673	2978
80	935	1113	1307	1515	1740	1980	2235	2505	2792
85	880	1048	1230	1426	1637	1863	2103	2358	2627
90	831	990	1161	1347	1546	1760	1986	2227	2481
95	788	937	1100	1276	1465	1667	1882	2110	2351
100	748	891	1045	1212	1392	1584	1788	2004	2233
105	713	848	995	1155	1325	1508	1703	1909	2127
110	680	810	950	1102	1265	1440	1625	1822	2030
115	651	774	909	1054	1210	1377	1554	1743	1942
120	623	742	871	1010	1160	1320	1490	1670	1861
125	598	712	836	970	1113	1267	1430	1603	1786
130	575	685	804	932	1070	1218	1375	1542	1718
135	554	660	774	898	1031	1173	1324	1485	1654
140	534	636	746	866	994	1131	1277	1431	1595
145	516	614	721	836	960	1092	1233	1382	1540
150	...	594	697	808	928	1056	1192	1336	1489
155	...	574	674	782	898	1021	1153	1293	1441
160	...	556	653	757	870	990	1117	1252	1396

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	3½	3¾	4	4¼	4½	4¾	5	5¼	5½
lbs.									
5	28297	32484	36960	41724	46777	...	...	...	...
10	14148	16242	18480	20862	23388	26059	28875	31834	34938
15	9432	10828	12320	13908	15592	17373	19250	21223	23292
20	7074	8121	9240	10431	11694	13029	14437	15917	17469
25	5659	6496	7392	8344	9355	10423	11550	12733	13975
30	4716	5414	6160	6954	7796	8686	9625	10611	11646
35	4042	4640	5280	5960	6682	7445	8250	9095	9982
40	3537	4060	4620	5215	5847	6514	7218	7958	8734
45	3144	3609	4106	4636	5197	5791	6416	7074	7764
50	2829	3248	3696	4172	4677	5211	5775	6366	6987
55	2572	2953	3360	3793	4252	4738	5250	5788	6352
60	2358	2707	3080	3477	3898	4343	4812	5305	5823
65	2176	2498	2843	3209	3598	4009	4442	4897	5375
70	2021	2320	2640	2980	3341	3722	4125	4547	4991
75	1886	2165	2464	2781	3118	3474	3850	4244	4658
80	1768	2030	2310	2607	2923	3257	3609	3979	4367
85	1664	1910	2174	2454	2751	3065	3397	3745	4110
90	1572	1804	2053	2318	2598	2895	3208	3537	3882
95	1489	1709	1945	2196	2461	2743	3039	3351	3677
100	1414	1624	1848	2086	2338	2605	2887	3183	3493
105	1347	1546	1760	1986	2227	2481	2750	3031	3327
110	1286	1476	1680	1896	2126	2369	2625	2894	3176
115	1230	1412	1606	1814	2033	2266	2510	2768	3038
120	1179	1353	1540	1738	1949	2171	2406	2652	2911
125	1131	1299	1478	1668	1871	2084	2310	2546	2795
130	1088	1249	1421	1604	1799	2004	2221	2448	2687
135	1048	1203	1368	1545	1732	1930	2138	2358	2588
140	1010	1160	1320	1490	1670	1861	2062	2273	2495
145	975	1120	1274	1438	1613	1797	1991	2195	2409
150	943	1082	1232	1390	1559	1737	1925	2122	2329
155	912	1047	1192	1345	1508	1681	1862	2053	2254
160	884	1015	1155	1303	1461	1628	1804	1989	2183

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼
lbs.									
5	47685	...	...	...	...	...	...	...	...
10	23842	26730	29782	33000	36382	39930	43642	47520	...
15	15895	17820	19855	22000	24255	26620	29095	31680	34375
20	11921	13365	14891	16500	18191	19965	21821	23760	25781
25	9537	10692	11913	13200	14553	15972	17457	19008	20625
30	7947	8910	9927	11000	12127	13310	14547	15840	17187
35	6812	7637	8509	9428	10395	11408	12469	13577	14732
40	5960	6682	7445	8250	9095	9982	10910	11880	12890
45	5298	5940	6618	7333	8085	8873	9698	10560	11458
50	4768	5346	5956	6600	7276	7986	8728	9504	10312
55	4335	4860	5415	6000	6615	7260	7935	8640	9374
60	3973	4455	4963	5500	6063	6655	7273	7920	8593
65	3668	4112	4581	5076	5597	6143	6714	7310	7932
70	3406	3818	4254	4714	5197	5704	6234	6788	7366
75	3179	3564	3971	4400	4851	5324	5819	6336	6875
80	2980	3341	3722	4125	4547	4991	5455	5940	6445
85	2805	3144	3503	3882	4280	4697	5134	5590	6066
90	2649	2970	3309	3666	4042	4436	4849	5280	5729
95	2509	2813	3135	3473	3829	4203	4593	5002	5427
100	2384	2673	2978	3300	3638	3993	4364	4752	5156
105	2270	2545	2836	3142	3465	3802	4156	4525	4910
110	2167	2430	2707	3000	3307	3630	3967	4320	4687
115	2073	2324	2589	2869	3163	3472	3795	4132	4483
120	1986	2227	2481	2750	3031	3327	3636	3960	4296
125	1907	2138	2382	2640	2910	3194	3491	3801	4125
130	1834	2056	2290	2538	2798	3071	3357	3655	3966
135	1766	1980	2206	2444	2695	2957	3232	3520	3819
140	1703	1909	2127	2357	2598	2852	3117	3394	3683
145	1644	1843	2053	2275	2509	2753	3009	3277	3556
150	1589	1782	1985	2200	2425	2662	2909	3168	3437
155	1538	1724	1921	2129	2347	2576	2815	3065	3326
160	1490	1670	1861	2062	2273	2495	2727	2970	3222

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	5	5¼	5½	5¾	6	6¼	6½	6¾	7
lbs.									
5	...	...	...	...	...	...	...	...	...
10	37125	40930	44921	49097	...	...	...	...	...
15	24750	27286	29947	32731	35640	38671	41827	45106	48510
20	18562	20465	22460	24548	26730	29003	31370	33830	36382
25	14850	16372	17968	19639	21384	23203	25096	27064	29106
30	12375	13643	14973	16365	17820	19335	20913	22553	24255
35	10607	11694	12834	14027	15274	16573	17926	19331	20790
40	9281	10232	11230	12274	13365	14501	15685	16915	18191
45	8250	9095	9982	10910	11880	12890	13942	15035	16170
50	7425	8186	8984	9819	10692	11601	12548	13532	14553
55	6750	7441	8167	8926	9720	10546	11407	12301	13230
60	6187	6821	7486	8182	8910	9667	10456	11276	12127
65	5711	6296	6910	7553	8224	8924	9652	10409	11194
70	5303	5847	6417	7013	7637	8286	8963	9665	10395
75	4950	5457	5989	6546	7128	7734	8365	9021	9702
80	4640	5116	5615	6137	6682	7250	7842	8457	9095
85	4367	4815	5284	5776	6289	6824	7381	7960	8560
90	4125	4547	4991	5455	5940	6445	6971	7517	8085
95	3907	4308	4728	5168	5627	6106	6604	7122	7659
100	3712	4093	4492	4909	5346	5800	6274	6766	7276
105	3535	3898	4278	4675	5091	5524	5975	6443	6930
110	3375	3720	4083	4463	4860	5273	5703	6150	6615
115	3228	3559	3906	4269	4648	5044	5455	5883	6327
120	3093	3410	3743	4091	4455	4833	5228	5638	6063
125	2970	3274	3593	3927	4276	4640	5019	5412	5821
130	2855	3148	3455	3776	4112	4462	4826	5204	5597
135	2750	3031	3327	3636	3960	4296	4647	5011	5390
140	2651	2923	3208	3506	3818	4143	4481	4832	5197
145	2560	2822	3098	3386	3686	4000	4326	4666	5018
150	2475	2728	2994	3273	3564	3867	4182	4510	4851
155	2395	2640	2898	3167	3449	3742	4047	4365	4694
160	2320	2558	2807	3068	3341	3625	3921	4228	4547

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	5¾	6	6¼	6½	6¾	7	7¼	7½	7¾
lbs.									
5	...	...	...	...	...	...	...	...	...
10	54553	...	...	...	...	...	...	...	...
15	36368	39600	42968	46475	...	...	...	...	...
20	27276	29700	32226	34856	37589	40425	43364	46406	49551
25	21821	23760	25781	27885	30071	32340	34691	37125	39641
30	18184	19800	21484	23237	25059	26950	28909	30937	33034
35	15586	16971	18415	19917	21479	23100	24779	26517	28315
40	13638	14850	16113	17428	18794	20212	21682	23203	24775
45	12122	13200	14322	15491	16706	17966	19272	20625	22022
50	10910	11880	12890	13942	15035	16170	17345	18562	19820
55	9918	10800	11718	12675	13668	14700	15768	16875	18018
60	9092	9900	10742	11618	12529	13475	14454	15468	16517
65	8392	9138	9915	10725	11565	12438	13342	14278	15246
70	7793	8485	9207	9958	10739	11550	12389	13258	14157
75	7273	7920	8593	9295	10023	10780	11563	12375	13213
80	6819	7425	8056	8714	9397	10106	10841	11601	12387
85	6418	6988	7582	8201	8844	9511	10203	10919	11659
90	6061	6600	7161	7745	8353	8983	9636	10312	11011
95	5742	6252	6784	7338	7913	8510	9129	9769	10431
100	5455	5940	6445	6971	7517	8085	8672	9281	9910
105	5195	5657	6138	6639	7159	7700	8259	8839	9438
110	4959	5400	5859	6337	6834	7350	7884	8437	9009
115	4743	5165	5604	6061	6537	7030	7541	8070	8617
120	4546	4950	5371	5809	6264	6737	7227	7734	8258
125	4364	4752	5156	5577	6014	6468	6938	7425	7928
130	4196	4569	4957	5362	5782	6219	6671	7139	7623
135	4040	4400	4774	5163	5568	5988	6424	6875	7340
140	3896	4242	4603	4979	5369	5775	6194	6629	7078
145	3762	4096	4445	4807	5184	5575	5981	6400	6834
150	3636	3960	4296	4647	5011	5390	5781	6187	6606
155	3519	3832	4158	4497	4850	5216	5595	5987	6393
160	3409	3712	4028	4357	4698	5053	5420	5800	6193

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	6½	6¾	7	7¼	7½	7¾	8	8¼	8½
lbs.									
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	38341	41347	44467	47700	...	...	...	...	...
25	30673	33078	35574	38160	40837	43605	46464	49413	...
30	25561	27565	29645	31800	34031	36337	38720	41177	43711
35	21909	23627	25410	27257	29169	31146	33188	35295	37466
40	19170	20673	22233	23850	25523	27253	29040	30883	32783
45	17040	18376	19763	21200	22687	24225	25813	27451	29140
50	15336	16539	17787	19080	20418	21802	23232	24706	26226
55	13942	15035	16170	17345	18562	19820	21120	22460	23842
60	12780	13782	14822	15900	17015	18168	19360	20588	21855
65	11797	12722	13682	14677	15706	16771	17870	19005	20174
70	10954	11813	12705	13628	14584	15573	16594	17647	18733
75	10224	11026	11858	12720	13612	14535	15488	16471	17484
80	9585	10336	11116	11925	12761	13626	14520	15441	16391
85	9021	9728	10462	11223	12011	12825	13665	14533	15427
90	8520	9188	9881	10600	11343	12112	12906	13725	14570
95	8071	8704	9361	10042	10746	11475	12227	13003	13803
100	7668	8269	8893	9540	10209	10901	11616	12353	13113
105	7303	7875	8470	9085	9723	10382	11062	11765	12488
110	6971	7517	8085	8672	9281	9910	10560	11230	11921
115	6668	7190	7733	8295	8877	9479	10100	10742	11402
120	6390	6891	7411	7950	8507	9084	9680	10294	10927
125	6134	6615	7114	7632	8167	8721	9292	9882	10490
130	5898	6361	6841	7338	7853	8385	8935	9502	10087
135	5680	6125	6587	7066	7562	8075	8604	9150	9713
140	5477	5906	6352	6814	7292	7786	8297	8823	9366
145	5288	5703	6133	6579	7040	7518	8011	8519	9043
150	5112	5513	5929	6360	6806	7267	7744	8235	8742
155	4947	5335	5737	6154	6586	7033	7494	7969	8460
160	4792	5168	5558	5962	6380	6813	7260	7720	8195

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	7¼	7½	7¾	8	8¼	8½	8¾	9	9¼
lbs.									
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	41629	44550	47569	...	...	...	...	...	...
30	34691	37125	39641	42240	44921	47685	...	...	...
35	29735	31821	33978	36205	38503	40872	43312	45822	48403
40	26018	27843	29730	31680	33690	35763	37898	40095	42353
45	23127	24750	26427	28160	29947	31790	33687	35640	37647
50	20814	22275	23784	25344	26952	28611	30318	32076	33882
55	18922	20250	21622	23040	24502	26010	27562	29160	30802
60	17345	18562	19820	21120	22460	23842	25265	26730	28235
65	16011	17134	18295	19495	20732	22008	23322	24673	26063
70	14867	15910	16989	18102	19251	20436	21656	22911	24201
75	13876	14850	15856	16896	17968	19074	20212	21384	22588
80	13009	13921	14865	15840	16845	17881	18949	20047	21176
85	12243	13102	13991	14908	15854	16830	17834	18868	19931
90	11563	12375	13213	14080	14973	15895	16843	17820	18823
95	10955	11723	12518	13338	14185	15058	15957	16882	17833
100	10407	11137	11892	12672	13476	14305	15159	16038	16941
105	9911	10607	11326	12068	12834	13624	14437	15274	16134
110	9461	10125	10811	11520	12251	13005	13781	14580	15401
115	9049	9684	10341	11019	11718	12439	13182	13946	14731
120	8672	9281	9910	10560	11230	11921	12632	13365	14117
125	8325	8910	9513	10137	10781	11444	12127	12830	13553
130	8005	8567	9147	9747	10366	11004	11661	12336	13031
135	7709	8250	8809	9386	9982	10596	11229	11880	12549
140	7433	7955	8494	9051	9625	10218	10828	11455	12100
145	7177	7681	8201	8739	9294	9865	10454	11060	11683
150	6938	7425	7928	8448	8984	9537	10106	10692	11294
155	6714	7185	7672	8175	8694	9229	9780	10347	10929
160	6504	6960	7432	7920	8422	8940	9474	10023	10588

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	8	8¼	8½	8¾	9	9¼	9½	9¾	10
lbs.									
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...
30	45760	48664	...	...	...	...	...	...	...
35	39222	41712	44278	46921	49641	...	...	...	...
40	34320	36498	38744	41056	43436	45882	48396	...	...
45	30506	32443	34439	36494	38610	40784	43019	45313	47666
50	27456	29198	30995	32845	34749	36706	38717	40781	42900
55	24960	26544	28177	29859	31590	33369	35197	37074	39000
60	22880	24332	25829	27371	28957	30588	32264	33984	35750
65	21120	22460	23842	25265	26730	28235	29782	31370	33000
70	19611	20856	22139	23460	24820	26218	27655	29129	30642
75	18304	19465	20663	21896	23166	24470	25811	27187	28600
80	17160	18249	19372	20528	21718	22941	24198	25488	26812
85	16150	17175	18232	19320	20440	21591	22774	23989	35235
90	15253	16221	17219	18247	19305	20392	21509	22656	23833
95	14450	15367	16313	17287	18288	19319	20377	21464	22578
100	13728	14599	15497	16422	17374	18353	19358	20390	21450
105	13074	13904	14759	15640	16547	17479	18436	19419	20428
110	12480	13272	14088	14929	15795	16684	17598	18537	19500
115	11937	12695	13476	14280	15108	15959	16833	17731	18652
120	11440	12166	12914	13685	14478	15294	16132	16992	17875
125	10982	11679	12398	13138	13899	14682	15486	16312	17160
130	10560	11230	11921	12632	13365	14117	14891	15685	16500
135	10168	10814	11479	12164	12870	13594	14339	15104	15888
140	9805	10428	11069	11730	12410	13109	13827	14564	15321
145	9467	10068	10688	11325	11982	12657	13350	14062	14793
150	9152	9732	10331	10948	11583	12235	12905	13593	14300
155	8856	9418	9998	10595	11209	11840	12489	13155	13838
160	8580	9124	9686	10264	10859	11470	12099	12744	13406

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

Pressure per sq. in.	Depths of Girders in inches.								
	8¾	9	9¼	9½	9¾	10	10¼	10½	10¾
lbs.									
5	...	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...	...
40	44214	46777	49412	...	...	...	...	...	...
45	39302	41580	43922	46328	48798	...	...	...	...
50	35371	37422	39529	41695	43918	46200	48538	...	...
55	32156	34020	35936	37905	39926	42000	44126	46305	48536
60	29476	31185	32941	34746	36599	38500	40449	42446	44491
65	27209	28786	30407	32073	33783	35538	37337	39181	41069
70	25265	26730	28235	29782	31370	33000	34670	36382	38135
75	23581	24948	26353	27797	29279	30800	32359	33957	35593
80	22107	23388	24706	26059	27449	28875	30336	31834	33368
85	20806	22012	23252	24526	25834	27176	28552	29962	31405
90	19651	20790	21961	23164	24399	25666	26966	28297	29661
95	18616	19695	20805	21945	23115	24315	25546	26808	28099
100	17685	18711	19764	20847	21959	23100	24269	25467	26694
105	16843	17820	18823	19855	20913	22000	23113	24255	25423
110	16078	17010	17968	18952	19963	21000	22063	23152	24268
115	15379	16270	17186	18128	19095	20086	21103	22145	23212
120	14738	15592	16470	17373	18299	19250	20224	21223	22245
125	14148	14968	15811	16678	17567	18480	19415	20374	21355
130	13604	14393	15203	16036	16891	17769	18668	19590	20534
135	13100	13860	14640	15442	16266	17111	17977	18865	19774
140	12632	13365	14117	14891	15685	16500	17335	18191	19067
145	12197	12904	13630	14377	15144	15931	16737	17563	18410
150	11790	12474	13176	13898	14639	15400	16179	16978	17796
155	11410	12071	12751	13450	14167	14903	15657	16430	17222
160	11053	11694	12353	13029	13724	14437	15168	15917	16684

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches.

CYLINDRICAL BOILER SHELLS.

Steel Plates from ¼ inch to 1⅜ inch thick.

Numerals and *Nominal* Factors from 4·5 to 6·9.*

By the use of the Tables Nos. 126 to 139 immediately following, and Nos. 352 to 379, the working pressure can be determined, for any given thickness of plate and given diameter, when the calculated percentage strength of the longitudinal joint is known and *nominal* factor fixed; the diameter can be determined for a given thickness of plate, when the calculated percentage of the longitudinal joint is known and factor determined; and what the calculated percentage of the longitudinal joint should be, for a given thickness of plate, a given diameter and a given working pressure and *nominal* factor; what the thickness of the plate should be, when it is known what the diameter, working pressure, *nominal* factor, and the calculated percentage of the longitudinal joint are to be; and the *nominal* factor which the boiler is, or will be, worked at can also be determined, if between 4·5 and 6·9, when the thickness of the plate, the working pressure, diameter, and calculated percentage of the longitudinal joints are known.

The tables are calculated for tensile strengths of steel plates of 26, 27, 28, 29, 30, 31, and 32 tons per square inch, and they apply equally to cylindrical shells, cylindrical steam receivers, or domes of boilers.

The *nominal* factors are given at the top of the column under the heading F.

The numerals in the columns N are those applicable to the thicknesses which they are opposite and tensile strength at the head of the table, and to the *nominal* factors at the head of the columns in which they are placed.

N = Numeral for the thickness, tensile strength, and *nominal* factor of safety.
°/ₒ = Calculated percentage of joint.
D = Diameter of boiler, inside, in inches.
B = Working pressure, in lbs., per square inch.
F = *Nominal* factor of safety.*

$$\frac{N \times \%}{D} = B.$$

$$\frac{N \times \%}{B} = D.$$

$$\frac{D \times B}{N} = \%.$$

$$\frac{D \times B}{\%} = N.$$

* For factors below 5 see Tables Nos. 352 to 365.

(1) If the working pressure has to be found when the plates are 1¼ inch thick, having a tensile strength of 28 tons per square inch, the *nominal* factor being 5, the calculated percentage of the joints 84·95, and the diameter of the boiler 174 inches :—

Then, opposite the thickness of the plate 1¼ inch, in the table for 28 tons, and under F 5, the *nominal* factor, the numeral is 313·6, and if this be multiplied by 84·95, the calculated percentage of the joints, and the product divided by 174, the diameter, the quotient equals the working pressure, or

$$\frac{313{\cdot}6 \times 84{\cdot}95}{174} = 153{\cdot}105 = B,$$

which is the working pressure required to be found, or, say, 155 lbs. per square inch.

If the tensile strength had been 29 tons per square inch, then, in the table for that tensile strength the numeral would be found to be 324·8, or

$$\frac{324{\cdot}8 \times 84{\cdot}95}{174} = 158{\cdot}57 = B,$$

(2) If the thickness of the plates is required to be determined, when the steel is assumed at 28 tons, the diameter of the boiler being 82 inches, the pressure 155 lbs., the *nominal* factor 5, and the calculated percentage of joints 81·49 (see Tables No. 140 to 161 on Riveting, Steel Plates and Steel Rivets) :—

Then, if 82, the diameter, be multiplied by 155, the pressure, and the product divided by 81·49, the calculated percentage of joints, the quotient equals the numeral applicable to the case, which should be looked for under F 5 (in the table for 28 tons steel), the *nominal* factor, and opposite the numeral the thickness required may be found, or

$$\frac{82 \times 155}{81{\cdot}49} = 155{\cdot}97 = N,$$

but the nearest numeral under F 5 is 156·8, and as it differs so little from 155·97 $\left(\text{that found by the formula } \frac{D \times B}{\%}\right)$, the thickness opposite N 156·8, and under F 5, is the thickness which practically meets the requirements of the case, viz., ⅝ inch.

(3) If the diameter has to be settled for a working pressure of 160 lbs. at a *nominal* factor 5, the thickness of plates being 1⅜ inch, and the calculated percentage of joints 84·95, and the tensile strength of the plates being 28 tons per square inch :—

Then, under F 5, the factor, and opposite 1⅜ inch, the thickness of the plates, in the table for 28 tons steel, the numeral is 344·96, and if it be multiplied by 84·95, the calculated percentage

of joint, and the product divided by 160, the pressure, the quotient equals what the diameter should be, or

$$\frac{344 \cdot 96 \times 84 \cdot 95}{160} = 183 \cdot 15 = D,$$

or say 15 feet 3 inches.

(4) If the calculated percentage of joints has to be determined when the plates are ½ inch thick, the tensile strength 28 tons, the *nominal* factor 5, the working pressure 100 lbs. and the diameter of the boiler 97 inches:—

Then, if 100, the pressure, be multiplied by 97, the diameter, and the product divided by the numeral, 125·44, found opposite ½ inch, the thickness (in table for 28 tons steel), and under F 5, the *nominal* factor, the quotient equals the calculated percentage of joint, or,

$$\frac{100 \times 97}{125 \cdot 44} = 77 \cdot 32 = \%,$$

but a suitable calculated percentage of joint for such a thickness of plate, when the riveting is as illustrated in Table No. 150, is 77·2, which is practically that arrived at, and may be adopted without materially affecting the result.

The calculated percentage of joints made of steel plates and steel rivets of various descriptions of riveting and of different thickness of plates, is given in Tables No. 140 to 161.

The *nominal* factor can be found by the tables, for each tensile strength of plate given, when, N, the numeral is found (by the formula $\left(\frac{D \times B}{\%}\right)$, for a given thickness, as above the numerals in any one column, the factor under F is the *nominal* factor in the particular case. If the exact numeral is not found opposite any given thickness, within the range of the tables, but a numeral comes between any two numerals, opposite the given thickness, then the *nominal* factor is between the factors at the top of the two columns in which the numerals are found—one slightly under and the other rather higher; therefore, the factor can always be determined within about 1 per cent., although the exact numeral may not be found in the tables.

Thus if the thickness be ½ inch and $\frac{D \times B}{\%} = 125 \cdot 44 = N$, 125·44 is found opposite ½ inch, for 28 tons steel, and at the top of the column the *nominal* factor is 5; but if by the formula the numeral arrived at had been, say, 124, which is a numeral between two numerals given in the tables opposite ½, then the *nominal* factor in such a case would be a little higher than 5, but less than 5·1. If the numeral found by the formula had been 104·53, the *nominal* factor would be 6, as 104·53 is found opposite ½ inch under the column F 6 in table for 28 tons steel.

CYLINDRICAL BOILER SHELLS.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 26 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5·0	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	58·24	57·09	56·0	54·94	53·92	52·94	52·0	51·08	50·20	49·35
9/32	65·52	64·23	63·0	61·81	60·66	59·56	58·5	57·47	56·48	55·52
5/16	72·80	71·37	70·0	68·67	67·40	66·18	65·0	63·85	62·75	61·69
11/32	80·08	78·50	77·0	75·54	74·14	72·80	71·5	70·24	69·03	67·86
3/8	87·36	85·64	84·0	82·41	80·88	79·41	78·0	76·63	75·31	74·03
13/32	94·64	92·78	91·0	89·28	87·62	86·03	84·5	83·01	81·58	80·20
7/16	101·92	99·92	98·0	96·15	94·37	92·65	91·0	89·40	87·86	86·37
15/32	109·20	107·05	105·0	103·01	101·11	99·27	97·5	95·78	94·13	92·54
1/2	116·48	114·19	112·0	109·88	107·85	105·89	104·0	102·17	100·41	98·71
17/32	123·76	121·33	119·0	116·75	114·59	112·50	110·5	108·56	106·68	104·88
9/16	131·04	128·47	126·0	123·62	121·33	119·12	117·0	114·94	112·96	111·05
19/32	138·32	135·60	133·0	130·49	128·07	125·74	123·5	121·33	119·24	117·22
5/8	145·60	142·74	140·0	137·35	134·81	132·36	130·0	127·71	125·51	123·38
21/32	152·88	149·88	147·0	144·22	141·55	138·98	136·5	134·10	131·79	129·55
11/16	160·16	157·01	154·0	151·09	148·29	145·60	143·0	140·49	138·06	135·72
23/32	167·44	164·15	161·0	157·96	155·03	152·21	149·5	146·87	144·34	141·89
3/4	174·72	171·29	168·0	164·83	161·77	158·83	156·0	153·26	150·62	148·06
25/32	182·0	178·43	175·0	171·69	168·51	165·45	162·5	159·64	156·89	154·23
13/16	189·28	185·56	182·0	178·56	175·25	172·07	169·0	166·03	163·17	160·40
27/32	196·56	192·70	189·0	185·43	182·00	178·69	175·5	172·42	169·44	166·57
7/8	203·84	199·84	196·0	192·30	188·74	185·30	182·0	178·80	175·72	172·74
29/32	211·12	206·98	203·0	199·16	195·48	191·92	188·5	185·19	182·0	178·91
15/16	218·40	214·11	210·0	206·03	202·22	198·54	195·0	191·57	188·27	185·08
31/32	225·68	221·25	217·0	212·90	208·96	205·16	201·5	197·96	194·55	191·25
1	232·96	228·39	224·0	219·77	215·70	211·78	208·0	204·35	200·82	197·42
1 1/32	240·24	235·52	231·0	226·64	222·44	218·40	214·5	210·73	207·10	203·59
1 1/16	247·52	242·66	238·0	233·50	229·18	225·01	221·0	217·12	213·37	209·76
1 3/32	254·80	249·80	245·0	240·37	235·92	231·63	227·5	223·50	219·65	215·93
1 1/8	262·08	256·94	252·0	247·24	242·66	238·25	234·0	229·89	225·93	222·10
1 5/32	269·36	264·07	259·0	254·11	249·40	244·87	240·5	236·28	232·20	228·27
1 3/16	276·64	271·21	266·0	260·98	256·14	251·49	247·0	242·66	238·48	234·44
1 7/32	283·92	278·35	273·0	267·84	262·88	258·10	253·5	249·05	244·75	240·61
1 1/4	291·20	285·49	280·0	274·71	269·62	264·72	260·0	255·43	251·03	246·77
1 9/32	298·48	292·62	287·0	281·58	276·37	271·34	266·5	261·82	257·31	252·94
1 5/16	305·76	299·76	294·0	288·45	283·11	277·96	273·0	268·21	263·58	259·11
1 11/32	313·04	306·90	301·0	295·32	289·85	284·58	279·5	274·59	269·86	265·28
1 3/8	320·32	314·03	308·0	302·18	296·59	291·20	286·0	280·98	276·13	271·45

N = Numeral. % = Calculated percentage strength of joint. B = Working Pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 26 tons per square inch.
Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6·0	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
inches.	N	N	N	N	N	N	N	N	N	N
$\frac{1}{4}$	48·53	47·73	46·96	46·22	45·50	44·80	44·12	43·46	42·82	42·20
$\frac{9}{32}$	54·60	53·70	52·83	52·0	51·18	50·40	49·63	48·89	48·17	47·47
$\frac{5}{16}$	60·66	59·67	58·70	57·77	56·87	56·0	55·15	54·32	53·52	52·75
$\frac{11}{32}$	66·73	65·63	64·58	63·55	62·56	61·60	60·66	59·76	58·88	58·02
$\frac{3}{8}$	72·80	71·60	70·45	69·33	68·25	67·20	66·18	65·19	64·23	63·30
$\frac{13}{32}$	78·86	77·57	76·32	75·11	73·93	72·80	71·69	70·62	69·58	68·57
$\frac{7}{16}$	84·93	83·54	82·19	80·88	79·62	78·40	77·21	76·05	74·94	73·85
$\frac{15}{32}$	91·0	89·50	88·06	86·66	85·31	84·0	82·72	81·49	80·29	79·13
$\frac{1}{2}$	97·06	95·47	93·93	92·44	91·0	89·60	88·24	86·92	85·64	84·40
$\frac{17}{32}$	103·13	101·44	99·80	98·22	96·68	95·20	93·75	92·35	91·0	89·68
$\frac{9}{16}$	109·20	107·40	105·67	104·0	102·37	100·80	99·27	97·79	96·35	94·95
$\frac{19}{32}$	115·26	113·37	111·54	109·77	108·06	106·40	104·78	103·22	101·70	100·23
$\frac{5}{8}$	121·33	119·34	117·41	115·55	113·75	112·0	110·30	108·65	107·05	105·50
$\frac{21}{32}$	127·40	125·31	123·29	121·33	119·43	117·60	115·81	114·08	112·41	110·78
$\frac{11}{16}$	133·46	131·27	129·16	127·11	125·12	123·20	121·33	119·52	117·76	116·05
$\frac{23}{32}$	139·53	137·24	135·03	132·88	130·81	128·80	126·84	124·95	123·11	121·33
$\frac{3}{4}$	145·60	143·21	140·90	138·66	136·50	134·40	132·36	130·38	128·47	126·60
$\frac{25}{32}$	151·66	149·18	146·77	144·44	142·18	140·0	137·87	135·82	133·82	131·88
$\frac{13}{16}$	157·73	155·14	152·64	150·22	147·87	145·60	143·39	141·25	139·17	137·15
$\frac{27}{32}$	163·80	161·11	158·51	156·0	153·56	151·20	148·90	146·68	144·52	142·43
$\frac{7}{8}$	169·86	167·08	164·38	161·77	159·25	156·80	154·42	152·11	149·88	147·71
$\frac{29}{32}$	175·93	173·04	170·25	167·55	164·93	162·40	159·93	157·55	155·23	152·98
$\frac{15}{16}$	182·0	179·01	176·12	173·33	170·62	168·0	165·45	162·98	160·58	158·26
$\frac{31}{32}$	188·06	184·98	182·0	179·11	176·31	173·60	170·96	168·41	165·94	163·53
1	194·13	190·95	187·87	184·88	182·0	179·20	176·48	173·85	171·29	168·81
$1\frac{1}{32}$	200·20	196·91	193·74	190·66	187·68	184·80	182·0	179·28	176·64	174·08
$1\frac{1}{16}$	206·26	202·88	199·61	196·44	193·37	190·40	187·51	184·71	182·0	179·36
$1\frac{3}{32}$	212·33	208·85	205·48	202·22	199·06	196·0	193·03	190·14	187·35	184·63
$1\frac{1}{8}$	218·40	214·81	211·35	208·0	204·75	201·60	198·54	195·58	192·70	189·91
$1\frac{5}{32}$	224·46	220·78	217·22	213·77	210·43	207·20	204·06	201·01	198·05	195·18
$1\frac{3}{16}$	230·53	226·75	223·09	219·55	216·12	212·80	209·57	206·44	203·41	200·46
$1\frac{7}{32}$	236·60	232·72	228·96	225·33	221·81	218·40	215·09	211·88	208·76	205·73
$1\frac{1}{4}$	242·66	238·68	234·83	231·11	227·5	224·0	220·60	217·31	214·11	211·01
$1\frac{9}{32}$	248·73	244·65	240·70	236·88	233·18	229·60	226·12	222·74	219·47	216·28
$1\frac{5}{16}$	254·80	250·62	246·58	242·66	238·87	235·20	231·63	228·17	224·82	221·56
$1\frac{11}{32}$	260·86	256·59	252·45	248·44	244·56	240·80	237·15	233·61	230·17	226·84
$1\frac{3}{8}$	266·93	262·55	258·32	254·22	250·25	246·40	242·66	239·04	235·52	232·11

N = Numeral. % = Calculated percentage strength of joint. B = Working Pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 27 tons per square inch.
Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5·0	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	60·48	59·29	58·15	57·05	56·0	54·98	54·0	53·05	52·13	51·25
9/32	68·04	66·70	65·42	64·18	63·0	61·85	60·75	59·68	58·65	57·66
5/16	75·60	74·11	72·69	71·32	70·0	68·72	67·50	66·31	65·17	64·06
11/32	83·16	81·52	79·96	78·45	77·0	75·60	74·25	72·94	71·68	70·47
3/8	90·72	88·94	87·23	85·58	84·0	82·47	81·0	79·57	78·20	76·83
13/32	98·28	96·35	94·50	92·71	91·0	89·34	87·75	86·21	84·72	83·28
7/16	105·84	103·76	101·76	99·84	98·0	96·21	94·50	92·84	91·24	89·69
15/32	113·40	111·17	109·03	106·98	105·0	103·09	101·25	99·47	97·75	96·10
1/2	120·96	118·58	116·30	114·11	112·0	109·96	108·0	106·10	104·27	102·50
17/32	128·52	126·0	123·57	121·24	119·0	116·83	114·75	112·73	110·79	108·91
9/16	136·08	133·41	130·84	128·37	126·0	123·70	121·5	119·36	117·31	115·32
19/32	143·64	140·82	138·11	135·50	133·0	130·58	128·25	126·0	123·82	121·72
5/8	151·20	148·23	145·38	142·64	140·0	137·45	135·0	132·63	130·34	128·13
21/32	158·76	155·64	152·65	149·77	147·0	144·32	141·75	139·26	136·86	134·54
11/16	166·32	163·05	159·92	156·90	154·0	151·20	148·5	145·89	143·37	140·94
23/32	173·88	170·47	167·19	164·03	161·0	158·07	155·25	152·52	149·89	147·35
3/4	181·44	177·88	174·46	171·16	168·0	164·94	162·0	159·15	156·41	153·76
25/32	189·0	185·29	181·73	178·30	175·0	171·81	168·75	165·78	162·93	160·16
13/16	196·56	192·70	189·0	185·43	182·0	178·69	175·5	172·42	169·44	166·57
27/32	204·12	200·11	196·26	192·56	189·0	185·56	182·25	179·05	175·96	172·98
7/8	211·68	207·52	203·53	199·69	196·0	192·43	189·0	185·68	182·48	179·38
29/32	219·24	214·94	210·80	206·83	203·0	199·30	195·75	192·31	189·0	185·79
15/16	226·80	222·35	218·07	213·96	210·0	206·18	202·5	198·94	195·51	192·20
31/32	234·36	229·76	225·34	221·09	217·0	213·05	209·25	205·57	202·03	198·61
1	241·92	237·17	232·61	228·22	224·0	219·92	216·0	212·21	208·55	205·01
1 1/32	249·48	244·58	239·88	235·35	231·0	226·80	222·75	218·84	215·06	211·42
1 1/16	257·04	252·0	247·15	242·49	238·0	233·67	229·5	225·47	221·58	217·83
1 3/32	264·60	259·41	254·42	249·62	245·0	240·54	236·25	232·10	228·10	224·23
1 1/8	272·16	266·82	261·69	256·75	252·0	247·41	243·0	238·73	234·62	230·64
1 5/32	279·72	274·23	268·96	263·88	259·0	254·29	249·75	245·36	241·13	237·05
1 3/16	287·28	281·64	276·23	271·01	266·0	261·16	256·5	252·0	247·65	243·45
1 7/32	294·84	289·05	283·50	278·15	273·0	268·03	263·25	258·63	254·17	249·86
1 1/4	302·40	296·47	290·76	285·28	280·0	274·90	270·0	265·26	260·68	256·27
1 9/32	309·96	303·88	298·03	292·41	287·0	281·78	276·75	271·89	267·20	262·67
1 5/16	317·52	311·29	305·30	299·54	294·0	288·65	283·5	278·52	273·72	269·08
1 11/32	325·08	318·70	312·57	306·67	301·0	295·52	290·25	285·15	280·24	275·49
1 3/8	332·64	326·11	319·84	313·81	308·0	302·40	297·0	291·78	286·75	281·89

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 27 tons per square inch.
Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6·0	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
Inches.	N	N	N	N	N	N	N	N	N	N
1/4	50·40	49·57	48·77	48·0	47·25	46·52	45·81	45·13	44·47	43·82
9/32	56·70	55·77	54·87	54·0	53·15	52·33	51·54	50·77	50·02	49·30
5/16	63·0	61·96	60·96	60·0	59·06	58·15	57·27	56·41	55·58	54·78
11/32	69·30	68·16	67·06	66·0	64·96	63·96	63·0	62·05	61·14	60·26
3/8	75·60	74·36	73·16	72·0	70·87	69·78	68·72	67·70	66·70	65·73
13/32	81·90	80·55	79·25	78·0	76·78	75·60	74·45	73·34	72·26	71·21
7/16	88·20	86·75	85·35	84·0	82·68	81·41	80·18	78·98	77·82	76·69
15/32	94·50	92·95	91·45	90·0	88·59	87·23	85·90	84·62	83·38	82·17
1/2	100·80	99·14	97·54	96·0	94·50	93·04	91·63	90·26	88·94	87·65
17/32	107·10	105·34	103·64	102·0	100·40	98·86	97·36	95·91	94·50	93·13
9/16	113·40	111·54	109·74	108·0	106·31	104·67	103·09	101·55	100·05	98·60
19/32	119·70	117·73	115·83	114·0	112·21	110·49	108·81	107·19	105·61	104·08
5/8	126·0	123·93	121·93	120·0	118·12	116·30	114·54	112·83	111·17	109·56
21/32	132·30	130·13	128·03	126·0	124·03	122·12	120·27	118·47	116·73	115·04
11/16	138·60	136·32	134·12	132·0	129·93	127·93	126·0	124·11	122·29	120·52
23/32	144·90	142·52	140·22	138·0	135·84	133·75	131·72	129·76	127·85	126·0
3/4	151·20	148·72	146·32	144·0	141·75	139·56	137·45	135·40	133·41	131·47
25/32	157·50	154·91	152·41	150·0	147·65	145·38	143·18	141·04	138·97	136·95
13/16	163·80	161·11	158·51	156·0	153·56	151·20	148·90	146·68	144·52	142·43
27/32	170·10	167·31	164·61	162·0	159·46	157·01	154·63	152·32	150·08	147·91
7/8	176·40	173·50	170·70	168·0	165·37	162·83	160·36	157·97	155·64	153·39
29/32	182·70	179·70	176·80	174·0	171·28	168·64	166·09	163·61	161·20	158·86
15/16	189·0	185·90	182·90	180·0	177·18	174·46	171·81	169·25	166·76	164·34
31/32	195·30	192·09	189·0	186·0	183·09	180·27	177·54	174·89	172·32	169·82
1	201·60	198·29	195·09	192·0	189·0	186·09	183·27	180·53	177·88	175·30
1 1/32	207·90	204·49	201·19	198·0	194·90	191·90	189·0	186·17	183·44	180·78
1 1/16	214·20	210·68	207·29	204·0	200·81	197·72	194·72	191·82	189·0	186·26
1 3/32	220·50	216·88	213·38	210·0	206·71	203·53	200·45	197·46	194·55	191·73
1 1/8	226·80	223·08	219·48	216·0	212·62	209·35	206·18	203·10	200·11	197·21
1 5/32	233·10	229·27	225·58	222·0	218·53	215·16	211·90	208·74	205·67	202·69
1 3/16	239·40	235·47	231·67	228·0	224·43	220·98	217·63	214·38	211·23	208·17
1 7/32	245·70	241·67	237·77	234·0	230·34	226·80	223·36	220·02	216·79	213·65
1 1/4	252·0	247·86	243·87	240·0	236·25	232·61	229·09	225·67	222·35	219·13
1 9/32	258·30	254·06	249·96	246·0	242·15	238·43	234·81	231·31	227·91	224·60
1 5/16	264·60	260·26	256·06	252·0	248·06	244·24	240·54	236·95	233·47	230·08
1 11/32	270·90	266·45	262·16	258·0	253·96	250·06	246·27	242·59	239·02	235·56
1 3/8	277·20	272·65	268·25	264·0	259·87	255·87	252·0	248·23	244·58	241·04

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 28 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5·0	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	62·72	61·49	60·30	59·16	58·07	57·01	56·0	55·01	54·06	53·15
9/32	70·56	69·17	67·84	66·56	65·33	64·14	63·0	61·89	60·82	59·79
5/16	78·40	76·86	75·38	73·96	72·59	71·27	70·0	68·77	67·58	66·44
11/32	86·24	84·54	82·92	81·35	79·85	78·40	77·0	75·64	74·34	73·08
3/8	94·08	92·23	90·46	88·75	87·11	85·52	84·0	82·52	81·10	79·72
13/32	101·92	99·92	98·0	96·15	94·37	92·65	91·0	89·40	87·86	86·37
7/16	109·76	107·60	105·53	103·54	101·62	99·78	98·0	96·28	94·62	93·01
15/32	117·60	115·29	113·07	110·94	108·88	106·90	105·0	103·15	101·37	99·66
1/2	125·44	122·98	120·61	118·33	116·14	114·03	112·0	110·03	108·13	106·30
17/32	133·28	130·66	128·15	125·73	123·40	121·16	119·0	116·91	114·89	112·94
9/16	141·12	138·35	135·69	133·13	130·66	128·29	126·0	123·78	121·65	119·59
19/32	148·96	146·03	143·23	140·52	137·92	135·41	133·0	130·66	128·41	126·2
5/8	156·80	153·72	150·76	147·92	145·18	142·54	140·0	137·54	135·17	132·8
21/32	164·64	161·41	158·30	155·32	152·44	149·67	147·0	144·42	141·93	139·5
11/16	172·48	169·09	165·84	162·71	159·70	156·80	154·0	151·29	148·68	146·1
23/32	180·32	176·78	173·38	170·11	166·96	163·92	161·0	158·17	155·44	152·8
3/4	188·16	184·47	180·92	177·50	174·22	171·05	168·0	165·05	162·20	159·4
25/32	196·0	192·15	188·46	184·90	181·48	178·18	175·0	171·92	168·96	166·1
13/16	203·84	199·84	196·0	192·30	188·74	185·30	182·0	178·80	175·72	172·7
27/32	211·68	207·52	203·53	199·69	196·0	192·43	189·0	185·68	182·48	179·3
7/8	219·52	215·21	211·07	207·09	203·25	199·56	196·0	192·56	189·24	186·0
29/32	227·36	222·90	218·61	214·49	210·51	206·69	203·0	199·43	196·0	192·6
15/16	235·20	230·58	226·15	221·88	217·77	213·81	210·0	206·31	202·75	199·3
31/32	243·04	238·27	233·69	229·28	225·03	220·94	217·0	213·19	209·51	205·9
1	250·88	245·96	241·23	236·67	232·29	228·07	224·0	220·07	216·27	212·6
1 1/32	258·72	253·64	248·76	244·07	239·55	235·20	231·0	226·94	223·03	219·2
1 1/16	266·56	261·33	256·30	251·47	246·81	242·32	238·0	233·82	229·79	225·8
1 3/32	274·40	269·01	263·84	258·86	254·07	249·45	245·0	240·70	236·55	232·5
1 1/8	282·24	276·70	271·38	266·26	261·33	256·58	252·0	247·57	243·31	239·1
1 5/32	290·08	284·39	278·92	273·66	268·59	263·70	259·0	254·45	250·06	245·8
1 3/16	297·92	292·07	286·46	281·05	275·85	270·83	266·0	261·33	256·82	252·4
1 7/32	305·76	299·76	294·0	288·45	283·11	277·96	273·0	268·21	263·58	259·1
1 1/4	313·60	307·45	301·53	295·84	290·37	285·09	280·0	275·08	270·34	265·7
1 9/32	321·44	315·13	309·07	303·24	297·62	292·21	287·0	281·96	277·10	272·4
1 5/16	329·28	322·82	316·61	310·64	304·88	299·34	294·0	288·84	283·86	279·0
1 11/32	337·12	330·50	324·15	318·03	312·14	306·47	301·0	295·71	290·62	285·6
1 3/8	344·96	338·19	331·69	325·43	319·40	313·60	308·0	302·59	297·37	292·3

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 28 tons per square inch.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6·0	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
Inches.	N	N	N	N	N	N	N	N	N	N
1/4	52·26	51·40	50·58	49·77	49·0	48·24	47·51	46·80	46·11	45·44
9/32	58·80	57·83	56·90	56·0	55·12	54·27	53·45	52·65	51·88	51·13
5/16	65·33	64·26	63·22	62·22	61·25	60·30	59·39	58·50	57·64	56·81
11/32	71·86	70·68	69·54	68·44	67·37	66·33	65·33	64·35	63·41	62·49
3/8	78·40	77·11	75·87	74·66	73·50	72·36	71·27	70·20	69·17	68·17
13/32	84·93	83·54	82·19	80·88	79·62	78·40	77·21	76·05	74·94	73·85
7/16	91·46	89·96	88·51	87·11	85·75	84·43	83·15	81·91	80·70	79·53
15/32	98·0	96·39	94·83	93·33	91·87	90·46	89·09	87·76	86·47	85·21
1/2	104·53	102·81	101·16	99·55	98·0	96·49	95·03	93·61	92·23	90·89
17/32	111·06	109·24	107·48	105·77	104·12	102·52	100·96	99·46	98·0	96·57
9/16	117·60	115·67	113·80	112·0	110·25	108·55	106·90	105·31	103·76	102·26
19/32	124·13	122·09	120·12	118·22	116·37	114·58	112·84	111·16	109·52	107·94
5/8	130·66	128·52	126·45	124·44	122·50	120·61	118·78	117·01	115·29	113·62
21/32	137·20	134·95	132·77	130·66	128·62	126·64	124·72	122·86	121·05	119·30
11/16	143·73	141·37	139·09	136·88	134·75	132·67	130·66	128·71	126·82	124·98
23/32	150·26	147·80	145·41	143·11	140·87	138·70	136·60	134·56	132·58	130·66
3/4	156·80	154·22	151·74	149·33	147·0	144·73	142·54	140·41	138·35	136·34
25/32	163·33	160·65	158·06	155·55	153·12	150·76	148·48	146·26	144·11	142·02
13/16	169·86	167·08	164·38	161·77	159·25	156·80	154·42	152·11	149·88	147·71
27/32	176·40	173·50	170·70	168·0	165·37	162·83	160·36	157·97	155·64	153·39
7/8	182·93	179·93	177·03	174·22	171·50	168·86	166·30	163·82	161·41	159·07
29/32	189·46	186·36	183·35	180·44	177·62	174·89	172·24	169·67	167·17	164·75
15/16	196·00	192·78	189·67	186·66	183·75	180·92	178·18	175·52	172·94	170·43
31/32	202·53	199·21	196·0	192·88	189·87	186·95	184·12	181·37	178·70	176·11
	209·06	205·63	202·32	199·11	196·0	192·98	190·06	187·22	184·47	181·79
1/32	215·60	212·06	208·64	205·33	202·12	199·01	196·0	193·07	190·23	187·47
1/16	222·13	218·49	214·96	211·55	208·25	205·04	201·93	198·92	196·0	193·15
3/32	228·66	224·91	221·29	217·77	214·37	211·07	207·87	204·77	201·76	198·84
1/8	235·20	231·34	227·61	224·0	220·5	217·10	213·81	210·62	207·52	204·52
5/32	241·73	237·77	233·93	230·22	226·62	223·13	219·75	216·47	213·29	210·20
3/16	248·26	244·19	240·25	236·44	232·75	229·16	225·69	222·32	219·05	215·88
7/32	254·80	250·62	246·58	242·66	238·87	235·20	231·63	228·17	224·82	221·56
1/4	261·33	257·04	252·90	248·88	245·0	241·23	237·57	234·02	230·58	227·24
9/32	267·86	263·47	259·22	255·11	251·12	247·26	243·51	239·88	236·35	232·92
5/16	274·40	269·90	265·54	261·33	257·25	253·29	249·45	245·73	242·11	238·60
11/32	280·93	276·32	271·87	267·55	263·37	259·32	255·39	251·58	247·88	244·28
3/8	287·46	282·75	278·19	273·77	269·5	265·35	261·33	257·43	253·64	249·97

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 29 tons per square inch.
Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5·0	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	64·96	63·68	62·46	61·28	60·14	59·05	58·0	56·98	56·0	55·05
9/32	73·08	71·64	70·26	68·94	67·66	66·43	65·25	64·10	63·0	61·93
5/16	81·20	79·60	78·07	76·60	75·18	73·81	72·5	71·22	70·0	68·81
11/32	89·32	87·56	85·88	84·26	82·70	81·20	79·75	78·35	77·0	75·69
3/8	97·44	95·52	93·69	91·92	90·22	88·58	87·0	85·47	84·0	82·57
13/32	105·56	103·49	101·50	99·58	97·74	95·96	94·25	92·59	91·0	89·45
7/16	113·68	111·45	109·30	107·24	105·25	103·34	101·5	99·71	98·0	96·33
15/32	121·80	119·41	117·11	114·90	112·77	110·72	108·75	106·84	105·0	103·22
1/2	129·92	127·37	124·92	122·56	120·29	118·10	116·0	113·96	112·0	110·10
17/32	138·04	135·33	132·73	130·22	127·81	125·49	123·25	121·08	119·0	116·98
9/16	146·16	143·29	140·53	137·88	135·33	132·87	130·5	128·21	126·0	123·86
19/32	154·28	151·25	148·34	145·54	142·85	140·25	137·75	135·33	133·0	130·74
5/8	162·40	159·21	156·15	153·20	150·37	147·63	145·0	142·45	140·0	137·62
21/32	170·52	167·17	163·96	160·86	157·88	155·01	152·25	149·57	147·0	144·50
11/16	178·64	175·13	171·76	168·52	165·40	162·40	159·5	156·70	154·0	151·38
23/32	186·76	183·09	179·57	176·18	172·92	169·78	166·75	163·82	161·0	158·27
3/4	194·88	191·05	187·38	183·84	180·44	177·16	174·0	170·94	168·0	165·15
25/32	203·0	199·01	195·19	191·50	187·96	184·54	181·25	178·07	175·0	172·03
13/16	211·12	206·98	203·0	199·16	195·48	191·92	188·5	185·19	182·0	178·91
27/32	219·24	214·94	210·80	206·83	203·0	199·30	195·75	192·31	189·0	185·79
7/8	227·36	222·90	218·61	214·49	210·51	206·69	203·0	199·43	196·0	192·67
29/32	235·48	230·86	226·42	222·15	218·03	214·07	210·25	206·56	203·0	199·55
15/16	243·60	238·82	234·23	229·81	225·55	221·45	217·5	213·68	210·0	206·44
31/32	251·72	246·78	242·03	237·47	233·07	228·83	224·75	220·80	217·0	213·32
1	259·84	254·74	249·84	245·13	240·59	236·21	232·0	227·92	224·0	220·20
1 1/32	267·96	262·70	257·65	252·79	248·11	243·60	239·25	235·05	231·0	227·08
1 1/16	276·08	270·66	265·46	260·45	255·62	250·98	246·5	242·17	238·0	233·96
1 3/32	284·20	278·62	273·26	268·11	263·14	258·36	253·75	249·29	245·0	240·84
1 1/8	292·32	286·58	281·07	275·77	270·66	265·74	261·0	256·42	252·0	247·72
1 5/32	300·44	294·54	288·88	283·43	278·18	273·12	268·25	263·54	259·0	254·61
1 3/16	308·56	302·50	296·69	291·09	285·70	280·50	275·5	270·66	266·0	261·49
1 7/32	316·68	310·47	304·50	298·75	293·22	287·89	282·75	277·78	273·0	268·37
1 1/4	324·80	318·43	312·30	306·41	300·74	295·27	290·0	284·91	280·0	275·25
1 9/32	332·92	326·39	320·11	314·07	308·25	302·65	297·25	292·03	287·0	282·13
1 5/16	341·04	334·35	327·92	321·73	315·77	310·03	304·5	299·15	294·0	289·01
1 11/32	349·16	342·31	335·73	329·39	323·29	317·41	311·75	306·28	301·0	295·89
1 3/8	357·28	350·27	343·53	337·05	330·81	324·80	319·0	313·40	308·0	302·77

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 133.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 29 tons per square inch.
Numerals and *Nominal* Factors from 6 to 6·9.

hick-ss of late.	F 6·0	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ches.	N	N	N	N	N	N	N	N	N	N
1/4	54·13	53·24	52·38	51·55	50·75	49·96	49·21	48·47	47·76	47·07
9/32	60·90	59·90	58·93	58·0	57·09	56·21	55·36	54·53	53·73	52·95
5/16	67·66	66·55	65·48	64·44	63·43	62·46	61·51	60·59	59·70	58·84
11/32	74·43	73·21	72·03	70·88	69·78	68·70	67·66	66·65	65·67	64·72
3/8	81·20	79·86	78·58	77·33	76·12	74·95	73·81	72·71	71·64	70·60
13/32	87·96	86·52	85·12	83·77	82·46	81·20	79·96	78·77	77·61	76·49
7/16	94·73	93·18	91·67	90·22	88·81	87·44	86·12	84·83	83·58	82·37
15/32	101·50	99·83	98·22	96·66	95·15	93·69	92·27	90·89	89·55	88·26
1/2	108·26	106·49	104·77	103·11	101·50	99·93	98·42	96·95	95·52	94·14
17/32	115·03	113·14	111·32	109·55	107·84	106·18	104·57	103·01	101·50	100·02
9/16	121·80	119·80	117·87	116·0	114·18	112·43	110·72	109·07	107·47	105·91
19/32	128·56	126·45	124·41	112·44	120·53	118·67	116·87	115·13	113·44	111·79
5/8	135·33	133·11	130·96	128·88	126·87	124·92	123·03	121·19	119·41	117·68
21/32	142·10	139·77	137·51	135·33	133·21	131·16	129·18	127·25	125·38	123·56
11/16	148·86	146·42	144·06	141·77	139·56	137·41	135·33	133·31	131·35	129·44
23/32	155·63	153·08	150·61	148·22	145·90	143·66	141·48	139·37	137·32	135·33
3/4	162·40	159·73	157·16	154·66	152·25	149·90	147·63	145·43	143·29	141·21
25/32	169·16	166·39	163·70	161·11	158·59	156·15	153·78	151·49	149·26	147·10
13/16	175·93	173·04	170·25	167·55	164·93	162·40	159·93	157·55	155·23	152·98
27/32	182·70	179·70	176·80	174·0	171·28	168·64	166·09	163·61	161·20	158·86
7/8	189·46	186·36	183·35	180·44	177·62	174·89	172·24	169·67	167·17	164·75
29/32	196·23	193·01	189·90	186·88	183·96	181·13	178·39	175·73	173·14	170·63
15/16	203·0	199·67	196·45	193·33	190·31	187·38	184·54	181·79	179·11	176·52
31/32	209·76	206·32	203·0	199·77	196·65	193·63	190·69	187·85	185·08	182·40
	216·53	212·98	209·54	206·22	203·0	199·87	196·84	193·91	191·05	188·28
1/32	223·30	219·63	216·09	212·66	209·34	206·12	203·0	199·97	197·02	194·17
1/16	230·06	226·29	222·64	219·11	215·68	212·36	209·15	206·02	203·0	200·05
3/32	236·83	232·95	229·19	225·55	222·03	218·61	215·30	212·08	208·97	205·94
1/8	243·60	239·60	235·74	232·0	228·37	224·86	221·45	218·14	214·94	211·82
5/32	250·36	246·26	242·29	238·44	234·71	231·10	227·60	224·20	220·91	217·71
3/16	257·13	252·91	248·83	244·88	241·06	237·35	233·75	230·26	226·88	223·59
7/32	263·90	259·57	255·38	251·33	247·40	243·60	239·90	236·32	232·85	229·47
1/4	270·66	266·22	261·93	257·77	253·75	249·84	246·06	242·38	238·82	235·36
9/32	277·43	272·88	268·48	264·22	260·09	256·09	252·21	248·44	244·79	241·24
5/16	284·20	279·54	275·03	270·66	266·43	262·33	258·36	254·50	250·76	247·13
11/32	290·96	286·19	281·58	277·11	272·78	268·58	264·51	260·56	256·73	253·01
3/8	297·73	292·85	288·12	283·55	279·12	274·83	270·66	266·62	262·70	258·89

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 30 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5·0	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	67·20	65·88	64·61	63·39	62·22	61·09	60·0	58·94	57·93	56·94
9/32	75·60	74·11	72·69	71·32	70·0	68·72	67·5	66·31	65·17	64·06
5/16	84·0	82·35	80·76	79·24	77·77	76·36	75·0	73·68	72·41	71·18
11/32	92·40	90·58	88·84	87·16	85·55	84·0	82·5	81·05	79·65	78·30
3/8	100·80	98·82	96·92	95·09	93·33	91·63	90·0	88·42	86·89	85·42
13/32	109·20	107·05	105·0	103·01	101·11	99·27	97·5	95·78	94·13	92·54
7/16	117·60	115·29	113·07	110·94	108·88	106·90	105·0	103·15	101·37	99·66
15/32	126·0	123·52	121·15	118·86	116·66	114·54	112·5	110·52	108·62	106·77
1/2	134·40	131·76	129·23	126·79	124·44	122·18	120·0	117·89	115·86	113·89
17/32	142·80	140·0	137·30	134·71	132·22	129·81	127·5	125·26	123·10	121·01
9/16	151·20	148·23	145·38	142·64	140·0	137·45	135·0	132·63	130·34	128·13
19/32	159·60	156·47	153·46	150·56	147·77	145·09	142·5	140·0	137·58	135·25
5/8	168·0	164·70	161·53	158·49	155·55	152·72	150·0	147·36	144·82	142·37
21/32	176·40	172·94	169·61	166·41	163·33	160·36	157·5	154·73	152·06	149·49
11/16	184·80	181·17	177·69	174·33	171·11	168·0	165·0	162·10	159·31	156·61
23/32	193·20	189·41	185·76	182·26	178·88	175·63	172·5	169·47	166·55	163·72
3/4	201·60	197·64	193·84	190·18	186·66	183·27	180·0	176·84	173·79	170·84
25/32	210·0	205·88	201·92	198·11	194·44	190·90	187·5	184·21	181·03	177·96
13/16	218·40	214·11	210·0	206·03	202·22	198·54	195·0	191·57	188·27	185·08
27/32	226·80	222·35	218·07	213·96	210·0	206·18	202·5	198·94	195·51	192·20
7/8	235·20	230·58	226·15	221·88	217·77	213·81	210·0	206·31	202·75	199·32
29/32	243·60	238·82	234·23	229·81	225·55	221·45	217·5	213·68	210·0	206·44
15/16	252·0	247·05	242·30	237·73	233·33	229·09	225·0	221·05	217·24	213·55
31/32	260·40	255·29	250·38	245·66	241·11	236·72	232·5	228·42	224·48	220·67
1	268·80	263·52	258·46	253·58	248·88	244·36	240·0	235·78	231·72	227·79
1 1/32	277·20	271·76	266·53	261·50	256·66	252·0	247·5	243·15	238·96	234·91
1 1/16	285·60	280·0	274·61	269·43	264·44	259·63	255·0	250·52	246·20	242·03
1 3/32	294·0	288·23	282·69	277·35	272·22	267·27	262·5	257·89	253·44	249·15
1 1/8	302·40	296·47	290·76	285·28	280·0	274·90	270·0	265·26	260·68	256·27
1 5/32	310·80	304·70	298·84	293·20	287·77	282·54	277·5	272·63	267·93	263·38
1 3/16	319·20	312·94	306·92	301·13	295·55	290·18	285·0	280·0	275·17	270·50
1 7/32	327·60	321·17	315·0	309·05	303·33	297·81	292·5	287·36	282·41	277·62
1 1/4	336·0	329·41	323·07	316·98	311·11	305·45	300·0	294·73	289·65	284·74
1 9/32	344·40	337·64	331·15	324·90	318·88	313·09	307·5	302·10	296·89	291·86
1 5/16	352·80	345·88	339·23	332·83	326·66	320·72	315·0	309·47	304·13	298·98
1 11/32	361·20	354·11	347·30	340·75	334·44	328·36	322·5	316·84	311·37	306·10
1 3/8	369·60	362·35	355·38	348·67	342·22	336·0	330·0	324·21	318·62	313·22

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 30 tons per square inch.
Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6·0	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	56·0	55·08	54·19	53·33	52·50	51·69	50·90	50·14	49·41	48·69
9/32	63·0	61·96	60·96	60·0	59·06	58·15	57·27	56·41	55·58	54·78
5/16	70·0	68·85	67·74	66·66	65·62	64·61	63·63	62·68	61·76	60·86
11/32	77·0	75·73	74·51	73·33	72·18	71·07	70·0	68·95	67·94	66·95
3/8	84·0	82·62	81·29	80·0	78·75	77·53	76·36	75·22	74·11	73·04
13/32	91·0	89·50	88·06	86·66	85·31	84·0	82·72	81·49	80·29	79·13
7/16	98·0	96·39	94·83	93·33	91·87	90·46	89·09	87·76	86·47	85·21
15/32	105·0	103·27	101·61	100·0	98·43	96·92	95·45	94·02	92·64	91·30
1/2	112·0	110·16	108·38	106·66	105·0	103·38	101·81	100·29	98·82	97·39
17/32	119·0	117·04	115·16	113·33	111·56	109·84	108·18	106·56	105·0	103·47
9/16	126·0	123·93	121·93	120·0	118·12	116·30	114·54	112·83	111·17	109·56
19/32	133·0	130·81	128·70	126·66	124·68	122·76	120·90	119·10	117·35	115·65
5/8	140·0	137·70	135·48	133·33	131·25	129·23	127·27	125·37	123·52	121·73
21/32	147·0	144·59	142·25	140·0	137·81	135·69	133·63	131·64	129·70	127·82
11/16	154·0	151·47	149·03	146·66	144·37	142·15	140·0	137·91	135·88	133·91
23/32	161·0	158·36	155·80	153·33	150·93	148·61	146·36	144·17	142·05	140·0
3/4	168·0	165·24	162·58	160·0	157·5	155·07	152·72	150·44	148·23	146·08
25/32	175·0	172·13	169·35	166·66	164·06	161·53	159·09	156·71	154·41	152·17
13/16	182·0	179·01	176·12	173·33	170·62	168·0	165·45	162·98	160·58	158·26
27/32	189·0	185·90	182·90	180·0	177·18	174·46	171·81	169·25	166·76	164·34
7/8	196·0	192·78	189·67	186·66	183·75	180·92	178·18	175·52	172·94	170·43
29/32	203·0	199·67	196·45	193·33	190·31	187·38	184·54	181·79	179·11	176·52
15/16	210·0	206·55	203·22	200·0	196·87	193·84	190·90	188·05	185·29	182·60
31/32	217·0	213·44	210·0	206·66	203·43	200·30	197·27	194·32	191·47	188·69
1	224·0	220·32	216·77	213·33	210·0	206·76	203·63	200·59	197·64	194·78
1 1/32	231·0	227·21	223·54	220·0	216·56	213·23	210·0	206·86	203·82	200·86
1 1/16	238·0	234·09	230·32	226·66	223·12	219·69	216·36	213·13	210·0	206·95
1 3/32	245·0	240·98	237·09	233·33	229·68	226·15	222·72	219·40	216·17	213·04
1 1/8	252·0	247·86	243·87	240·0	236·25	232·61	229·09	225·67	222·35	219·13
1 5/32	259·0	254·75	250·64	246·66	242·81	239·07	235·45	231·94	228·52	225·21
1 3/16	266·0	261·63	257·41	253·33	249·37	245·53	241·81	238·20	234·70	231·30
1 7/32	273·0	268·52	264·19	260·0	255·93	252·0	248·18	244·47	240·88	237·39
1 1/4	280·0	275·40	270·96	266·66	262·50	258·46	254·54	250·74	247·05	243·47
1 9/32	287·0	282·29	277·74	273·33	269·06	264·92	260·90	257·01	253·23	249·56
1 5/16	294·0	289·18	284·51	280·0	275·62	271·38	267·27	263·28	259·41	255·65
1 11/32	301·0	296·06	291·29	286·66	282·18	277·84	273·63	269·55	265·58	261·73
1 3/8	308·0	302·95	298·06	293·33	288·75	284·30	280·0	275·82	271·76	267·82

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 31 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5·0	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	69·44	68·07	66·76	65·50	64·29	63·12	62·0	60·91	59·86	58·84
9/32	78·12	76·58	75·11	73·69	72·33	71·01	69·75	68·52	67·34	66·20
5/16	86·80	85·09	83·46	81·88	80·37	78·90	77·5	76·14	74·82	73·55
11/32	95·48	93·60	91·80	90·07	88·40	86·80	85·25	83·75	82·31	80·91
3/8	104·16	102·11	100·15	98·26	96·44	94·69	93·0	91·36	89·79	88·27
13/32	112·84	110·62	108·50	106·45	104·48	102·58	100·75	98·98	97·27	95·62
7/16	121·52	119·13	116·84	114·64	112·51	110·47	108·5	106·59	104·75	102·98
15/32	130·20	127·64	125·19	122·83	120·55	118·36	116·25	114·21	112·24	110·33
1/2	138·88	136·15	133·53	131·01	128·59	126·25	124·0	121·82	119·72	117·69
17/32	147·56	144·66	141·88	139·20	136·62	134·14	131·75	129·43	127·20	125·05
9/16	156·24	153·17	150·23	147·39	144·66	142·03	139·5	137·05	134·68	132·40
19/32	164·92	161·68	158·57	155·58	152·70	149·92	147·25	144·66	142·17	139·76
5/8	173·60	170·19	166·92	163·77	160·74	157·81	155·0	152·28	149·65	147·11
21/32	182·28	178·70	175·26	171·96	168·77	165·70	162·75	159·89	157·13	154·47
11/16	190·96	187·21	183·61	180·15	176·81	173·60	170·5	167·50	164·62	161·83
23/32	199·64	195·72	191·96	188·33	184·85	181·49	178·25	175·12	172·10	169·18
3/4	208·32	204·23	200·30	196·52	192·88	189·38	186·0	182·73	179·58	176·54
25/32	217·0	212·74	208·65	204·71	200·92	197·27	193·75	190·35	187·06	183·89
13/16	225·68	221·25	217·0	212·90	208·96	205·16	201·5	197·96	194·55	191·25
27/32	234·36	229·76	225·34	221·09	217·0	213·05	209·25	205·57	202·03	198·61
7/8	243·04	238·27	233·69	229·28	225·03	220·94	217·0	213·19	209·51	205·96
29/32	251·72	246·78	242·03	237·47	233·07	228·83	224·75	220·80	217·0	213·32
15/16	260·40	255·29	250·38	245·66	241·11	236·72	232·5	228·42	224·48	220·67
31/32	269·08	263·80	258·73	253·84	249·14	244·61	240·25	236·03	231·96	228·03
1	277·76	272·31	267·07	262·03	257·18	252·50	248·0	243·64	239·44	235·38
1 1/32	286·44	280·82	275·42	270·22	265·22	260·40	255·75	251·26	246·93	242·74
1 1/16	295·12	289·33	283·76	278·41	273·25	268·29	263·5	258·87	254·41	250·10
1 3/32	303·80	297·84	292·11	286·60	281·29	276·18	271·25	266·49	261·89	257·45
1 1/8	312·48	306·35	300·46	294·79	289·33	284·07	279·0	274·10	269·37	264·81
1 5/32	321·16	314·86	308·80	302·98	297·37	291·96	286·75	281·71	276·86	272·16
1 3/16	329·84	323·37	317·15	311·16	305·40	299·85	294·5	289·33	284·34	279·52
1 7/32	338·52	331·88	325·50	319·35	313·44	307·74	302·25	296·94	291·82	286·88
1 1/4	347·20	340·39	333·84	327·54	321·48	315·63	310·0	304·56	299·31	294·23
1 9/32	355·88	348·90	342·19	335·73	329·51	323·52	317·75	312·17	306·79	301·59
1 5/16	364·56	357·41	350·53	343·92	337·55	331·41	325·5	319·78	314·27	308·94
1 11/32	373·24	365·92	358·88	352·11	345·59	339·30	333·25	327·40	321·75	316·30
1 3/8	381·92	374·43	367·23	360·30	353·62	347·20	341·0	335·01	329·24	323·66

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 137.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 31 tons per square inch.
Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6·0	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	57·86	56·91	56·0	55·11	54·25	53·41	52·60	51·82	51·05	50·31
9/32	65·10	64·03	63·0	62·0	61·03	60·09	59·18	58·29	57·44	56·60
5/16	72·33	71·14	70·0	68·88	67·81	66·76	65·75	64·77	63·82	62·89
11/32	79·56	78·26	77·0	75·77	74·59	73·44	72·33	71·25	70·20	69·18
3/8	86·80	85·37	84·0	82·66	81·37	80·12	78·90	77·73	76·58	75·47
13/32	94·03	92·49	91·0	89·55	88·15	86·80	85·48	84·20	82·97	81·76
7/16	101·26	99·60	98·0	96·44	94·93	93·47	92·06	90·68	89·35	88·05
15/32	108·50	106·72	105·0	103·33	101·71	100·15	98·63	97·16	95·73	94·34
1/2	115·73	113·83	112·0	110·22	108·50	106·83	105·21	103·64	102·11	100·63
17/32	122·96	120·95	119·0	117·11	115·28	113·50	111·78	110·11	108·50	106·92
9/16	130·20	128·06	126·0	124·0	122·06	120·18	118·36	116·59	114·88	113·21
19/32	137·43	135·18	133·0	130·88	128·84	126·86	124·93	123·07	121·26	119·50
5/8	144·66	142·29	140·0	137·77	135·62	133·53	131·51	129·55	127·64	125·79
21/32	151·90	149·40	147·0	144·66	142·40	140·21	138·09	136·02	134·02	132·08
11/16	159·13	156·52	154·0	151·55	149·18	146·89	144·66	142·50	140·41	138·37
23/32	166·36	163·63	161·0	158·44	155·96	153·56	151·24	148·98	146·79	144·66
3/4	173·60	170·75	168·0	165·33	162·75	160·24	157·81	155·46	153·17	150·95
25/32	180·83	177·86	175·0	172·22	169·53	166·92	164·39	161·94	159·55	157·24
13/16	188·06	184·98	182·0	179·11	176·31	173·60	170·96	168·41	165·94	163·53
27/32	195·30	192·09	189·0	186·0	183·09	180·27	177·54	174·89	172·32	169·82
7/8	202·53	199·21	196·0	192·88	189·87	186·95	184·12	181·37	178·70	176·11
29/32	209·76	206·32	203·0	199·77	196·65	193·63	190·69	187·85	185·08	182·40
15/16	217·0	213·44	210·0	206·66	203·43	200·30	197·27	194·32	191·47	188·69
31/32	224·23	220·55	217·0	213·55	210·21	206·98	203·84	200·80	197·85	194·98
1	231·46	227·67	224·0	220·44	217·0	213·66	210·42	207·28	204·23	201·27
1 1/32	238·70	234·78	231·0	227·33	223·78	220·33	217·0	213·76	210·61	207·56
1 1/16	245·93	241·90	238·0	234·22	230·56	227·01	223·57	220·23	217·0	213·85
1 3/32	253·16	249·01	245·0	241·11	237·34	233·69	230·15	226·71	223·38	220·14
1 1/8	260·40	256·13	252·0	248·0	244·12	240·36	236·72	233·19	229·76	226·43
1 5/32	267·63	263·24	259·0	254·88	250·90	247·04	243·30	239·67	236·14	232·72
1 3/16	274·86	270·36	266·0	261·77	257·68	253·72	249·87	246·14	242·52	239·01
1 7/32	282·10	277·47	273·0	268·66	264·46	260·40	256·45	252·62	248·91	245·30
1 1/4	289·33	284·59	280·0	275·55	271·25	267·07	263·03	259·10	255·29	251·59
1 9/32	296·56	291·70	287·0	282·44	278·03	273·75	269·60	265·58	261·67	257·88
1 5/16	303·80	298·81	294·0	289·33	284·81	280·43	276·18	272·05	268·05	264·17
1 11/32	311·03	305·93	301·0	296·22	291·59	287·10	282·75	278·53	274·44	270·46
1 3/8	318·26	313·04	308·0	303·11	298·37	293·78	289·33	285·01	280·82	276·75

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 32 tons per square inch.
Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5·0	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	71·68	70·27	68·92	67·62	66·37	65·16	64·0	62·87	61·79	60·74
9/32	80·64	79·05	77·53	76·07	74·66	73·30	72·0	70·73	69·51	68·33
5/16	89·60	87·84	86·15	84·52	82·96	81·45	80·0	78·59	77·24	75·93
11/32	98·56	96·62	94·76	92·98	91·25	89·60	88·0	86·45	84·96	83·52
3/8	107·52	105·41	103·38	101·43	99·55	97·74	96·0	94·31	92·68	91·11
13/32	116·48	114·19	112·0	109·88	107·85	105·89	104·0	102·17	100·41	98·71
7/16	125·44	122·98	120·61	118·33	116·14	114·03	112·0	110·03	108·13	106·30
15/32	134·40	131·76	129·23	126·79	124·44	122·18	120·0	117·89	115·86	113·89
1/2	143·36	140·54	137·84	135·24	132·74	130·32	128·0	125·75	123·58	121·49
17/32	152·32	149·33	146·46	143·69	141·03	138·47	136·0	133·61	131·31	129·08
9/16	161·28	158·11	155·07	152·15	149·33	146·61	144·0	141·47	139·03	136·67
19/32	170·24	166·90	163·69	160·60	157·62	154·76	152·0	149·33	146·75	144·27
5/8	179·20	175·68	172·30	169·05	165·92	162·90	160·0	157·19	154·48	151·86
21/32	188·16	184·47	180·92	177·50	174·22	171·05	168·0	165·05	162·20	159·45
11/16	197·12	193·25	189·53	185·96	182·51	179·20	176·0	172·91	169·93	167·05
23/32	206·08	202·03	198·15	194·41	190·81	187·34	184·0	180·77	177·65	174·64
3/4	215·04	210·82	206·76	202·86	199·11	195·49	192·0	188·63	185·37	182·23
25/32	224·0	219·60	215·38	211·32	207·40	203·63	200·0	196·49	193·10	189·83
13/16	232·96	228·39	224·0	219·77	215·70	211·78	208·0	204·35	200·82	197·42
27/32	241·92	237·17	232·61	228·22	224·0	219·92	216·0	212·21	208·55	205·01
7/8	250·88	245·96	241·23	236·67	232·29	228·07	224·0	220·07	216·27	212·61
29/32	259·84	254·74	249·84	245·13	240·59	236·21	232·0	227·92	224·0	220·20
15/16	268·80	263·52	258·46	253·58	248·88	244·36	240·0	235·78	231·72	227·79
31/32	277·76	272·31	267·07	262·03	257·18	252·50	248·0	243·64	239·44	235·38
1	286·72	281·09	275·69	270·49	265·48	260·65	256·0	251·50	247·17	242·98
1 1/32	295·68	289·88	284·30	278·94	273·77	268·80	264·0	259·36	254·89	250·57
1 1/16	304·64	298·66	292·92	287·39	282·07	276·94	272·0	267·22	262·62	258·16
1 3/32	313·60	307·45	301·53	295·84	290·37	285·09	280·0	275·08	270·34	265·76
1 1/8	322·56	316·23	310·15	304·30	298·66	293·23	288·0	282·94	278·06	273·35
1 5/32	331·52	325·01	318·76	312·75	306·96	301·38	296·0	290·80	285·79	280·94
1 3/16	340·48	333·80	327·38	321·20	315·25	309·52	304·0	298·66	293·51	288·54
1 7/32	349·44	342·58	336·0	329·66	323·55	317·67	312·0	306·52	301·24	296·13
1 1/4	358·40	351·37	344·61	338·11	331·85	325·81	320·0	314·38	308·96	303·72
1 9/32	367·36	360·15	353·23	346·56	340·14	333·96	328·0	322·24	316·68	311·32
1 5/16	376·32	368·94	361·84	355·01	348·44	342·10	336·0	330·10	324·41	318·91
1 11/32	385·28	377·72	370·46	363·47	356·74	350·25	344·0	337·96	332·13	326·50
1 3/8	394·24	386·50	379·07	371·92	365·03	358·40	352·0	345·82	339·86	334·10

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 32 tons per square inch.
Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6·0	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
inches.	N	N	N	N	N	N	N	N	N	N
1/4	59·73	58·75	57·80	56·88	56·0	55·13	54·30	53·49	52·70	51·94
9/32	67·20	66·09	65·03	64·0	63·0	62·03	61·09	60·17	59·29	58·43
5/16	74·66	73·44	72·25	71·11	70·0	68·92	67·87	66·86	65·88	64·92
11/32	82·13	80·78	79·48	78·22	77·0	75·81	74·66	73·55	72·47	71·42
3/8	89·60	88·13	86·70	85·33	84·0	82·70	81·45	80·23	79·05	77·91
13/32	97·06	95·47	93·93	92·44	91·0	89·60	88·24	86·92	85·64	84·40
7/16	104·53	102·81	101·16	99·55	98·0	96·49	95·03	93·61	92·23	90·89
15/32	112·0	110·16	108·38	106·66	105·0	103·38	101·81	100·29	98·82	97·39
1/2	119·46	117·50	115·61	113·77	112·0	110·27	108·60	106·98	105·41	103·88
17/32	126·93	124·85	122·83	120·88	119·0	117·16	115·39	113·67	112·0	110·37
9/16	134·40	132·19	130·06	128·0	126·0	124·06	122·18	120·35	118·58	116·86
19/32	141·86	139·54	137·29	135·11	133·0	130·95	128·96	127·04	125·17	123·36
5/8	149·33	146·88	144·51	142·22	140·0	137·84	135·75	133·73	131·76	129·85
21/32	156·80	154·22	151·74	149·33	147·0	144·73	142·54	140·41	138·35	136·34
11/16	164·26	161·57	158·96	156·44	154·0	151·63	149·33	147·10	144·94	142·84
23/32	171·73	168·91	166·19	163·55	161·0	158·52	156·12	153·79	151·52	149·33
3/4	179·20	176·26	173·41	170·66	168·0	165·41	162·90	160·47	158·11	155·82
25/32	186·66	183·60	180·64	177·77	175·0	172·30	169·69	167·16	164·70	162·31
13/16	194·13	190·95	187·87	184·88	182·0	179·20	176·48	173·85	171·29	168·81
27/32	201·60	198·29	195·09	192·0	189·0	186·09	183·27	180·53	177·88	175·30
7/8	209·06	205·63	202·32	199·11	196·0	192·98	190·06	187·22	184·47	181·79
29/32	216·53	212·98	209·54	206·22	203·0	199·87	196·84	193·91	191·05	188·28
15/16	224·0	220·32	216·77	213·33	210·0	206·76	203·63	200·59	197·64	194·78
31/32	231·46	227·67	224·0	220·44	217·0	213·66	210·42	207·28	204·23	201·27
1	238·93	235·01	231·22	227·55	224·0	220·55	217·21	213·97	210·82	207·76
1 1/32	246·40	242·36	238·45	234·66	231·0	227·44	224·0	220·65	217·41	214·26
1 1/16	253·86	249·70	245·67	241·77	238·0	234·33	230·78	227·34	224·0	220·75
1 3/32	261·33	257·04	252·90	248·88	245·0	241·23	237·57	234·02	230·58	227·24
1 1/8	268·80	264·39	260·12	256·0	252·0	248·12	244·36	240·71	237·17	233·73
1 5/32	276·26	271·73	267·35	233·11	259·0	255·01	251·15	247·40	243·76	240·23
1 3/16	283·73	279·08	274·58	270·22	266·0	261·90	257·93	254·08	250·35	246·72
1 7/32	291·20	286·42	281·80	277·33	273·0	268·80	264·72	260·77	256·94	253·21
1 1/4	298·66	293·77	289·03	284·44	280·0	275·69	271·51	267·46	263·52	259·71
1 9/32	306·13	301·11	296·25	291·55	287·0	282·58	278·30	274·14	270·11	266·20
1 5/16	313·60	308·45	303·48	298·66	294·0	289·47	285·09	280·83	276·70	272·69
1 11/32	321·06	315·80	310·70	305·77	301·0	296·36	291·87	287·52	283·29	279·18
1 3/8	328·53	323·14	317·93	312·88	308·0	303·26	298·66	294·20	289·88	285·68

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

STEEL PLATES AND STEEL RIVETS.

Riveted Joints.

In the Tables Nos. 140, to 161, immediately following, and No. 348, the particulars as to the proportions of riveted joints made of steel plates with steel rivets are given. By the use of the Tables the working pressure may be found for any given diameter of boiler and *nominal* factor of safety, or the diameter determined for a given working pressure and *nominal* factor, or the *nominal* factor ascertained for a given pressure and diameter.

Tables Nos. 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 348, have been computed on the assumption that the tensile strength of steel boiler plates is 28 tons per square inch, and the shearing strength of the rivets 23 tons per square inch; the tables on the right hand side of each of these tables give the numerals applicable for steel plates, having tensile strengths of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

There is frequently a difference of a few tons in the tensile strength of a batch of plates, but the strength either 26, 27, or 28 tons, &c., according to which is the weakest plate in the batch, should be used in making the calculations, and the numerals should be selected from the column with the suitable strength at the top.

The calculated percentage of joint as given opposite the thickness of plate, in each case, is when the diameter of rivets and pitch of rivets are in accordance with the tables, and centre of rivets to edge of plates and distance between rows of rivets, not less than given opposite the particular thickness of plate.

The pitches of the rivets in column p are given in the tables in decimal parts of an inch, but the nearest $1/_{32}$ part of an inch may be adopted without materially affecting the result.

The distance between the rows of rivets in column V. and centre of rivets to edge of plates, in column E, should not be less than given in the table for the description of joint, as shown by the sketches at the top of the table and opposite the particular thickness of plate.

N = Numeral opposite the thickness of the plate, and applicable to the description of riveting as shown in the sketches at the top of the table from which the numeral is selected, and the riveting proportioned as given opposite the thickness in

question. *The table used must always be that for the particular description of joint that is being dealt with, and the numeral that for the particular tensile strength of the plate.*

D = Diameter of boiler, inside, in inches.
B = Working pressure, in lbs. per square inch.
F = Nominal factor of safety, the value of which should in a great measure be determined according to the method of construction.

$$D \times B \times F = N.$$

$$\frac{N}{B \times F} = D.$$

$$\frac{N}{D \times F} = B.$$

$$\frac{N}{D \times B} = F.$$

(1) If the working pressure is required to be found when the longitudinal seams are treble riveted, double butt joints with each alternate rivet omitted in the outer row, either zigzag or chain riveted, the plates of steel $1\frac{1}{4}$ inch thick and the rivets also of steel, the inside diameter of the boiler 172 inches, the *nominal* factor of safety 5, and the tensile strength of the plate 28 tons :—

In the table of steel plates and steel rivets, treble riveted double butt joints, with each alternate rivet omitted in the outer row, either zigzag or chain riveted, as shown in the sketch at the top of the Table No. 160 * opposite $1\frac{1}{4}$, the thickness of the plate, the numeral N (for 28 tons steel) is found to be 133201, and if that be divided by the product of 172, the diameter, and 5, the *nominal* factor, the quotient is the working pressure. The calculated percentage strength of the joint is 84·95, as found on the right opposite the thickness $1\frac{1}{4}$ inch, which it is, if the riveting be of the description stated, and the pitch and rivets, &c., are as given opposite the thickness of plate, or

$$\frac{133201}{172 \times 5} = 154{\cdot}8 = B,$$

or, say, 155 lbs., which is the working pressure in lbs. per square inch.*

If 30 tons is taken as the tensile strength instead of 28, the pressure

* See note (*a*), page 297.

can be found in the same way. The numeral in this case is 142715, then

$$\frac{142715}{172 \times 5} = 165 \cdot 9 = B,$$

or, say, 166 lbs. per square inch.

(2) If the diameter of a boiler is required to be determined when the riveting is the *same* as before and the plates also $1\frac{1}{4}$ inch thick, the *nominal* factor 5, and the pressure 155 pounds:—

Opposite $1\frac{1}{4}$ inch, thickness of plate, the numeral N (for 28 tons steel) is 133201, which divided by 155×5 (the pressure and factor respectively), equals the working pressure, or

$$\frac{133201}{155 \times 5} = 171 \cdot 8 \text{ inches} = D,$$

which is the inside diameter, in inches, the boiler may be, or, say, 172 inches.

If 32 tons were assumed as the tensile strength of the plate, instead of 28 tons, as above, the numeral will be found to be 152229, then

$$\frac{152229}{155 \times 5} = 196 \cdot 4 \text{ inches} = D,$$

or, say, $196\frac{1}{2}$ inches.

(3) If it is wished to determine what thickness the shell of a steel boiler should be if the working pressure is required to be 155 lbs., the diameter 172 inches, and the *nominal* factor 5, and the joints, treble riveted double butt joints with each alternate rivet omitted in the outer row, either zigzag or chain riveted, the steel being assumed at 28 tons tensile strength:—

The product of 155, the pressure, 172, the diameter, and 5, the *nominal* factor, equals 133300, which is practically equal to the numeral 133201, which is the nearest numeral, N (for 28 tons steel), in the table for the description of joint specified, and opposite this numeral the thickness of plate is $1\frac{1}{4}$ inch, which is the thickness the shell should be. The particulars of the riveting and calculated percentage of joint are found on the right opposite the thickness $1\frac{1}{4}$ inch.

(4) If it is wished to determine what factor of safety a boiler is working at when the riveting is the same as before, the plates $1\frac{1}{4}$ inch thick (opposite which the calculated percentage 84·95 is found on the right), the numeral, N (for 28 tons steel), opposite $1\frac{1}{4}$ inch on the left, 133201, the diameter 172 inches and the pressure 155 lbs.:—

The factor of safety is found by dividing the numeral 133201 by the product of 172, the diameter, and 155, the pressure, or

$$\frac{133201}{172 \times 155} = 4{\cdot}99 = F,$$

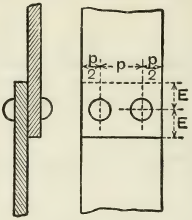
or, say, 5, which is the *nominal* factor such a boiler works at under the circumstances stated.

The foregoing remarks will facilitate the use of Tables 140 to 161, 48, and 349, Steel Plates and Steel Rivets, but the Table for the articular description of joint must be used, as each Table is only pplicable to the description of joints shown in the sketches at the top f the Table, and the numeral for the particular tensile strength of lates which is being dealt with.

The pressure, &c., arrived at may sometimes be fractionally over or nder a whole number, but such slight differences can be adjusted ccording to the circumstances of the case, even a lb. or two more or ss will not *generally* be a serious matter; for instance, if the pressure rrived at is, say, 158 lbs., no great loss would result from working at 55 lbs., and no great harm if at 160 lbs., if the circumstances of the ase should make it desirable to do so.

(*a*) In Tables Nos. 348 and 349 with the same description of riveting as in Table No. 160, a greater percentage of riveting is obtained, and, consequently, also a higher pressure for the same thickness of plates, but the riveting in Table No. 160 is recommended, as the pitches are not quite so wide.

Single Riveted Lap Joints.



28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Percentage of Joint.
N	T	d	p	E	
17561	1/4	11/16	1·562	1·031	56·00
19756	9/32	23/32	1·633	1·078	56·00
21952	5/16	3/4	1·704	1·125	56·00
24147	11/32	25/32	1·775	1·171	56·00
26342	3/8	13/16	1·846	1·218	56·00
28537	13/32	27/32	1·917	1·265	56·00
30732	7/16	7/8	1·988	1·312	56·00
32622	15/32	29/32	2·036	1·359	55·48
34326	1/2	15/16	2·071	1·406	54·73
36012	17/32	31/32	2·108	1·453	54·04
37679	9/16	1	2·146	1·500	53·40
39340	19/32	1 1/32	2·186	1·546	52·82
40995	5/8	1 1/16	2·227	1·593	52·29
42633	21/32	1 3/32	2·269	1·640	51·79
44275	11/16	1 1/8	2·312	1·687	51·34
45909	23/32	1 5/32	2·356	1·734	50·92
47529	3/4	1 3/16	2·400	1·781	50·52
49147	25/32	1 7/32	2·445	1·828	50·15
50572	13/16	1 1/4	2·500	1·875	49·62
51851	27/32	1 9/32	2·562	1·921	48·99
53101	7/8	1 5/16	2·625	1·968	48·38
54355	29/32	1 11/32	2·687	2·015	47·84
55636	15/16	1 3/8	2·750	2·062	47·31

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joints is as given opposite the same thickness in the Table immediately preceding.

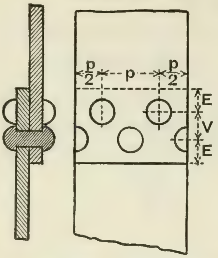
Thickness of Plates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
¼	16306	16933	17561	18188	18815	19442	20069
9/32	18344	19050	19756	20461	21167	21872	22578
5/16	20384	21168	21952	22736	23520	24304	25088
11/32	22422	23284	24147	25009	25871	26734	27596
⅜	24460	25401	26342	27282	28223	29164	30105
13/32	26498	27517	28537	29556	30575	31594	32613
7/16	28536	29634	30732	31829	32927	34024	35122
15/32	30291	31456	32622	33787	34952	36117	37282
½	31874	33100	34326	35551	36777	38003	39229
17/32	33439	34725	36012	37298	38584	39870	41156
9/16	34987	36333	37679	39024	40370	41716	43061
19/32	36530	37935	39340	40745	42150	43555	44960
⅝	38066	39530	40995	42459	43923	45387	46851
21/32	39587	41110	42633	44155	45678	47200	48723
11/16	41112	42693	44275	45856	47437	49018	50600
23/32	42629	44269	45909	47548	49188	50827	52467
¾	44134	45831	47529	49226	50923	52621	54318
25/32	45636	47391	49147	50902	52657	54412	56168
13/16	46959	48765	50572	52378	54184	55990	57796
27/32	48147	49999	51851	53702	55554	57406	59258
⅞	49308	51204	53101	54997	56893	58790	60686
29/32	50472	52413	54355	56296	58237	60178	62120
15/16	51662	53649	55636	57623	59610	61597	63584

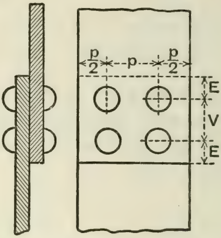
N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

Double Riveted Lap Joints.

Zig Zag Riveting. Chain Riveting.





28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Chain Riveting.	Percentage of Joint.
N	T	d	p	E	V	V	
27440	5/16	11/16	2·291	1·031	1·187	1·875	70·00
30184	11/32	23/32	2·395	1·078	1·240	1·937	70·00
32928	3/8	3/4	2·500	1·125	1·295	2·000	70·00
35672	13/32	25/32	2·604	1·171	1·349	2·062	70·00
38416	7/16	13/16	2·708	1·218	1·403	2·125	70·00
41095	15/32	27/32	2·803	1·265	1·453	2·187	69·89
43458	1/2	7/8	2·850	1·312	1·487	2·250	69·29
45815	17/32	29/32	2·900	1·359	1·522	2·312	68·75
48157	9/16	15/16	2·953	1·406	1·558	2·375	68·25
50489	19/32	31/32	3·008	1·453	1·595	2·437	67·79
52810	5/8	1	3·064	1·500	1·631	2·500	67·36
55121	21/32	1 1/32	3·122	1·546	1·669	2·562	66·96
57427	11/16	1 1/16	3·181	1·593	1·707	2·625	66·59
59731	23/32	1 3/32	3·241	1·640	1·745	2·687	66·25
62017	3/4	1 1/8	3·302	1·687	1·784	2·750	65·92
64307	25/32	1 5/32	3·364	1·734	1·823	2·812	65·62
66594	13/16	1 3/16	3·427	1·781	1·863	2·875	65·34
68870	27/32	1 7/32	3·490	1·828	1·902	2·937	65·07
71146	7/8	1 1/4	3·554	1·875	1·942	3·000	64·82
73414	29/32	1 9/32	3·618	1·921	1·981	3·062	64·58
75687	15/16	1 5/16	3·683	1·968	2·021	3·125	64·36
77942	31/32	1 11/32	3·748	2·015	2·061	3·187	64·14
80206	1	1 3/8	3·814	2·062	2·102	3·250	63·94

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure in pounds per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

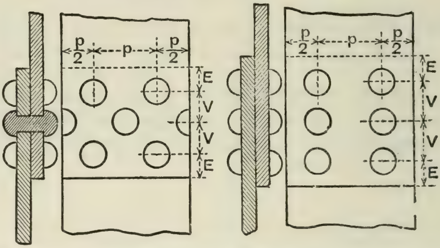
These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

Thickness of Plates. T	26 tons. D×B×F. N	27 tons. D×B×F. N	28 tons. D×B×F. N	29 tons. D×B×F. N	30 tons D×B×F. N	31 tons. D×B×F. N	32 tons. D×B×F. N
5/16	25480	26460	27440	28420	29400	30380	31360
11/32	28028	29106	30184	31262	32340	33418	34496
3/8	30576	31752	32928	34104	35280	36456	37632
13/32	33124	34398	35672	36946	38220	39494	40768
7/16	35672	37044	38416	39788	41160	42532	43904
15/32	38159	39627	41095	42562	44030	45498	46965
1/2	40353	41905	43458	45010	46562	48114	49666
17/32	42542	44178	45815	47451	49087	50723	52360
9/16	44717	46437	48157	49876	51596	53316	55036
19/32	46882	48685	50489	52292	54095	55898	57701
5/8	49037	50923	52810	54696	56582	58468	60354
21/32	51183	53152	55121	57089	59058	61026	62995
11/16	53325	55376	57427	59477	61528	63579	65630
23/32	55464	57597	59731	61864	63997	66130	68264
3/4	57587	59802	62017	64231	66446	68661	70876
25/32	59713	62010	64307	66603	68900	71197	73493
13/16	61837	64215	66594	68972	71350	73729	76107
27/32	63950	66410	68870	71329	73789	76248	78708
7/8	66064	68605	71146	73686	76227	78768	81309
29/32	68170	70792	73414	76035	78657	81279	83901
15/16	70280	72983	75687	78390	81093	83796	86499
31/32	72374	75158	77942	80725	83509	86292	89076
1	74477	77341	80206	83070	85935	88799	91664

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

Treble Riveted Lap Joints.



28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Percentage of Joint.
N	T	d	p	E	V	V	
35750	3/8	11/16	2·864	1·031	1·386	1·875	76·00
38729	13/32	23/32	2·994	1·078	1·449	1·937	76·00
41708	7/16	3/4	3·125	1·125	1·513	2·000	76·00
44688	15/32	25/32	3·255	1·171	1·576	2·062	76·00
47579	1/2	13/16	3·367	1·218	1·632	2·125	75·86
50279	17/32	27/32	3·437	1·265	1·674	2·187	75·45
52962	9/16	7/8	3·509	1·312	1·717	2·250	75·06
55636	19/32	29/32	3·583	1·359	1·761	2·312	74·70
58306	5/8	15/16	3·659	1·406	1·805	2·375	74·37
60966	21/32	31/32	3·736	1·453	1·850	2·437	74·06
63627	11/16	1	3·815	1·500	1·895	2·500	73·78
66276	23/32	1 1/32	3·894	1·546	1·940	2·562	73·51
68932	3/4	1 1/16	3·975	1·593	1·986	2·625	73·27
71579	25/32	1 3/32	4·057	1·640	2·032	2·687	73·04
74207	13/16	1 1/8	4·139	1·687	2·078	2·750	72·81
76850	27/32	1 5/32	4·222	1·734	2·125	2·812	72·61
79488	7/8	1 3/16	4·306	1·781	2·172	2·875	72·42
82111	29/32	1 7/32	4·390	1·828	2·219	2·937	72·23
84742	15/16	1 1/4	4·475	1·875	2·266	3·000	72·06
87372	31/32	1 9/32	4·560	1·921	2·313	3·062	71·90
89990	1	1 5/16	4·646	1·968	2·361	3·125	71·74
92621	1 1/32	1 11/32	4·732	2·015	2·409	3·187	71·60
95241	1 1/16	1 3/8	4·818	2·062	2·456	3·250	71·46

N=Numeral appropriate to the thickness of plate and tensile strength of steel.
B=Working pressure, in pounds, per square inch.
D=Diameter of boiler, inside, in inches. F=*Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

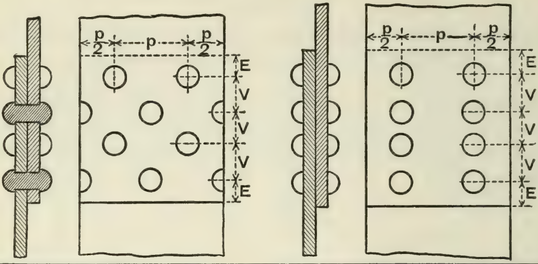
hick-ss of lates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
3/8	33196	34473	35750	37026	38303	39580	40857
3/32	35962	37345	38729	40112	41495	42878	44261
7/16	38728	40218	41708	43197	44687	46176	47666
5/32	41496	43092	44688	46284	47880	49476	51072
1/2	44180	45879	47579	49278	50977	52676	54376
7/32	46687	48483	50279	52074	53870	55666	57461
9/16	49179	51070	52962	54853	56745	58636	60528
9/32	51662	53649	55636	57623	59610	61597	63584
5/8	54141	56223	58306	60388	62470	64553	66635
1/32	56611	58788	60966	63143	65320	67498	69675
1/16	59082	61354	63627	65899	68171	70444	72716
3/32	61542	63909	66276	68643	71010	73377	75744
3/4	64008	66470	68932	71393	73855	76317	78779
5/32	66466	69022	71579	74135	76691	79248	81804
3/16	68906	71556	74207	76857	79507	82157	84808
7/32	71360	74105	76850	79594	82339	85083	87828
7/8	73810	76649	79488	82326	85165	88004	90843
9/32	76245	79178	82111	85043	87976	90908	93841
5/16	78689	81715	84742	87768	90795	93821	96848
1/32	81131	84251	87372	90492	93612	96733	99853
	83562	86776	89990	93203	96417	99631	102845
1/32	86005	89313	92621	95928	99236	102544	105852
1/16	88438	91839	95241	98642	102043	105445	108846

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

Quadruple Riveted Lap Joints.

Zig Zag Riveting. **Chain Riveting.**



28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Percentage of Joint.
N	T	d	p	E	V	V	
43904	7/16	11/16	3·437	1·031	1·584	1·875	80·00
46934	15/32	23/32	3·562	1·078	1·645	1·937	79·82
49837	1/2	3/4	3·653	1·125	1·694	2·000	79·46
52738	17/32	25/32	3·746	1·171	1·745	2·062	79·14
55629	9/16	13/16	3·841	1·218	1·795	2·125	78·84
58511	19/32	27/32	3·937	1·265	1·847	2·187	78·56
61402	5/8	7/8	4·036	1·312	1·899	2·250	78·32
64275	21/32	29/32	4·135	1·359	1·952	2·312	78·08
67146	11/16	15/16	4·236	1·406	2·005	2·375	77·86
70018	23/32	31/32	4·338	1·453	2·058	2·437	77·66
72883	3/4	1	4·440	1·500	2·111	2·500	77·47
75754	25/32	1 1/32	4·544	1·546	2·165	2·562	77·30
78621	13/16	1 1/16	4·648	1·593	2·219	2·625	77·14
81475	27/32	1 3/32	4·752	1·640	2·273	2·687	76·98
84328	7/8	1 1/8	4·857	1·687	2·328	2·750	76·83
87192	29/32	1 5/32	4·963	1·734	2·382	2·812	76·70
90046	15/16	1 3/16	5·069	1·781	2·437	2·875	76·57
92889	31/32	1 7/32	5·175	1·828	2·492	2·937	76·44
95748	1	1 1/4	5·282	1·875	2·547	3·000	76·33
98598	1 1/32	1 9/32	5·389	1·921	2·602	3·062	76·22
101439	1 1/16	1 5/16	5·496	1·968	2·657	3·125	76·11
104299	1 3/32	1 11/32	5·604	2·015	2·712	3·187	76·02
107138	1 1/8	1 3/8	5·711	2·062	2·767	3·250	75·92

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

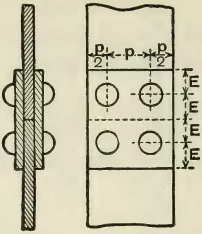
These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

Thickness of Plates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
7/16	40768	42336	43904	45472	47040	48608	50176
15/32	43581	45257	46934	48610	50286	51962	53638
1/2	46277	48057	49837	51616	53396	55176	56956
17/32	48971	50854	52738	54621	56505	58388	60272
9/16	51655	53642	55629	57615	59602	61589	63576
19/32	54331	56421	58511	60600	62690	64780	66869
5/8	57032	59226	61420	63613	65807	68000	70194
21/32	59683	61979	64275	66570	68866	71161	73457
11/16	62350	64748	67147	69545	71943	74341	76739
23/32	65016	67517	70018	72518	75019	77519	80020
3/4	67677	70280	72883	75485	78088	80691	83294
25/32	70343	73048	75754	78459	81165	83870	86576
13/16	73005	75813	78621	81428	84236	87044	89852
27/32	75655	78565	81475	84384	87294	90204	93114
7/8	78304	81316	84328	87339	90351	93363	96374
29/32	80964	84078	87192	90306	93420	96534	99648
15/16	83614	86830	90046	93261	96477	99693	102909
31/32	86254	89571	92889	96206	99523	102841	106158
1	88908	92328	95748	99167	102587	106006	109426
1 1/32	91555	95076	98598	102119	105640	109162	112683
1 1/16	94193	97816	101439	105061	108684	112307	115930
1 3/32	96849	100574	104299	108023	111748	115473	119198
1 1/8	99485	103311	107138	110964	114790	118617	122443

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

Single Riveted Double Butt Joints.



28 tons. D×B×F. N	Thickness of Plates. T	Diameter of Rivets. d	Pitch of Rivets. p	Centre of Rivets to Edge of Plates. E	Thickness of Butt Straps. T_1	Percentage of Joint.
30576	3/8	11/16	1·964	1·031	·234	65·00
33124	13/32	23/32	2·053	1·078	·253	65·00
35672	7/16	3/4	2·142	1·125	·273	65·00
38220	15/32	25/32	2·232	1·171	·292	65·00
40586	1/2	13/16	2·303	1·218	·312	64·71
42769	17/32	27/32	2·356	1·265	·332	64·18
44946	9/16	7/8	2·411	1·312	·351	63·70
47116	19/32	29/32	2·467	1·359	·371	63·26
49290	5/8	15/16	2·525	1·406	·390	62·87
51441	21/32	31/32	2·583	1·453	·410	62·49
53589	11/16	1	2·642	1·500	·429	62·14
55727	23/32	1 1/32	2·701	1·546	·449	61·81
57868	3/4	1 1/16	2·761	1·593	·468	61·51
60015	25/32	1 3/32	2·822	1·640	·488	61·24
62140	13/16	1 1/8	2·883	1·687	·507	60·97
64276	27/32	1 5/32	2·945	1·734	·527	60·73
66393	7/8	1 3/16	3·006	1·781	·546	60·49
68526	29/32	1 7/32	3·069	1·828	·566	60·28
70642	15/16	1 1/4	3·131	1·875	·585	60·07
72766	31/32	1 9/32	3·194	1·921	·605	59·88
74887	1	1 5/16	3·257	1·968	·625	59·70
76995	1 1/32	1 11/32	3·320	2·015	·644	59·52
79101	1 1/16	1 3/8	3·383	2·062	·664	59·35

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31, and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

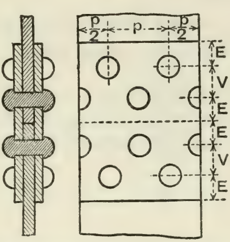
Thickness of Plates.	26 tons. D×B×F	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
3/8	28392	29484	30576	31668	32760	33852	34944
13/32	30758	31941	33124	34307	35490	36673	37856
7/16	33124	34398	35672	36946	38220	39494	40768
15/32	35490	36855	38220	39585	40950	42315	43680
1/2	37687	39136	40586	42035	43485	44934	46384
17/32	39714	41241	42769	44296	45823	47351	48878
9/16	41735	43340	44946	46551	48156	49761	51366
19/32	43750	45433	47116	48798	50481	52164	53846
5/8	45769	47529	49290	51050	52810	54571	56331
21/32	47766	49603	51441	53278	55115	56952	58789
11/16	49761	51675	53589	55502	57416	59330	61244
23/32	51746	53736	55727	57717	59707	61697	63688
3/4	53734	55801	57868	59934	62001	64068	66134
25/32	55728	57871	60015	62158	64301	66445	68588
13/16	57701	59920	62140	64359	66578	68797	71017
27/32	59684	61980	64276	66571	68867	71162	73458
7/8	61650	64021	66393	68764	71135	73506	75877
29/32	63631	66078	68526	70973	73420	75868	78315
15/16	65596	68119	70642	73164	75687	78210	80733
31/32	67568	70167	72766	75364	77963	80562	83161
	69537	72212	74887	77561	80236	82910	85585
1/32	71495	74245	76995	79744	82494	85244	87994
1/16	73450	76275	79101	81926	84751	87576	90401

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

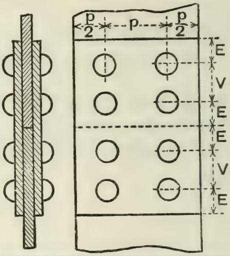
$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

Double Riveted Double Butt Joints.

Zig Zag Riveting.



Chain Riveting.



28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
42806	7/16	11/16	3·126	1·031	1·477	1·875	·273	78·00
45617	15/32	23/32	3·206	1·078	1·522	1·937	·292	77·58
48419	1/2	3/4	3·290	1·125	1·570	2·000	·312	77·20
51212	17/32	25/32	3·375	1·171	1·617	2·062	·332	76·85
53999	9/16	13/16	3·462	1·218	1·665	2·125	·351	76·53
56776	19/32	27/32	3·551	1·265	1·714	2·187	·371	76·23
59552	5/8	7/8	3·641	1·312	1·763	2·250	·390	75·96
62324	21/32	29/32	3·732	1·359	1·812	2·312	·410	75·71
65093	11/16	15/16	3·824	1·406	1·862	2·375	·429	75·48
67854	23/32	31/32	3·917	1·453	1·912	2·437	·449	75·26
70616	3/4	1	4·010	1·500	1·963	2·500	·468	75·06
73372	25/32	1 1/32	4·104	1·546	2·013	2·562	·488	74·87
76124	13/16	1 1/16	4·199	1·593	2·064	2·625	·507	74·69
78882	27/32	1 3/32	4·295	1·640	2·115	2·687	·527	74·53
81628	7/8	1 1/8	4·391	1·687	2·166	2·750	·546	74·37
84384	29/32	1 5/32	4·487	1·734	2·217	2·812	·566	74·23
87118	15/16	1 3/16	4·583	1·781	2·269	2·875	·585	74·08
89864	31/32	1 7/32	4·680	1·828	2·320	2·937	·605	73·95
92612	1	1 1/4	4·778	1·875	2·372	3·000	·625	73·83
95351	1 1/32	1 9/32	4·875	1·921	2·423	3·062	·644	73·71
98094	1 1/16	1 5/16	4·973	1·968	2·475	3·125	·664	73·60
100842	1 3/32	1 11/32	5·071	2·015	2·527	3·187	·683	73·50
103567	1 1/8	1 3/8	5·169	2·062	2·579	3·250	·703	73·39

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

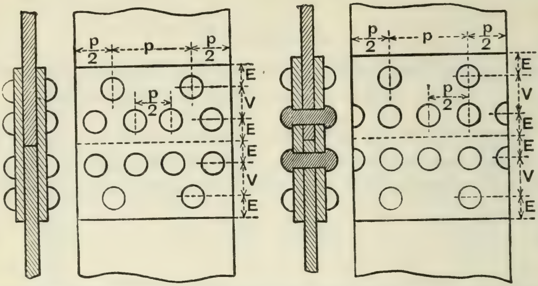
Thickness of Plates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
7/16	39748	41277	42806	44334	45863	47392	48921
15/32	42358	43987	45617	47246	48875	50504	52133
1/2	44960	46689	48419	50148	51877	53606	55336
17/32	47554	49383	51212	53041	54870	56699	58528
9/16	50141	52070	53999	55927	57856	59784	61713
19/32	52720	54748	56776	58803	60831	62859	64886
5/8	55298	57425	59552	61678	63805	65932	68059
21/32	57872	60098	62324	64549	66775	69001	71227
11/16	60443	62768	65093	67417	69742	72067	74392
23/32	63007	65430	67854	70277	72700	75124	77547
3/4	65572	68094	70616	73138	75660	78182	80704
25/32	68131	70751	73372	75992	78612	81233	83853
13/16	70686	73405	76124	78842	81561	84280	86998
27/32	73247	76064	78882	81699	84516	87333	90150
7/8	75797	78712	81628	84543	87458	90373	93289
29/32	78356	81370	84384	87397	90411	93425	96438
15/16	80895	84006	87118	90229	93340	96452	99563
31/32	83445	86654	89864	93073	96282	99492	102701
1	85996	89304	92612	95919	99227	102534	105842
1 1/32	88540	91945	95351	98756	102161	105567	108972
1 1/16	91087	94590	98094	101597	105100	108604	112107
1 3/32	93639	97240	100842	104443	108045	111646	115248
1 1/8	96169	99868	103567	107265	110964	114663	118362

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

Double Riveted Double Butt Joints, each alternate Rivet omitted in the outer rows.

Zig Zag Riveting. Chain Riveting.



28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
51631	1/2	11/16	3·889	1·031	1·578	1·875	·398	82·32
54698	17/32	23/32	4·012	1·078	1·639	1·937	·424	82·08
57767	9/16	3/4	4·137	1·125	1·701	2·000	·451	81·87
60820	19/32	25/32	4·262	1·171	1·762	2·062	·478	81·66
63888	5/8	13/16	4·390	1·218	1·824	2·125	·505	81·49
66942	21/32	27/32	4·518	1·265	1·886	2·187	·532	81·32
69992	11/16	7/8	4·646	1·312	1·948	2·250	·559	81·16
73047	23/32	29/32	4·776	1·359	2·011	2·312	·586	81·02
76101	3/4	15/16	4·906	1·406	2·073	2·375	·613	80·89
79144	25/32	31/32	5·037	1·453	2·136	2·437	·640	80·76
82198	13/16	1	5·168	1·500	2·198	2·500	·668	80·65
85243	27/32	1 1/32	5·300	1·546	2·261	2·562	·695	80·54
88279	7/8	1 1/16	5·432	1·593	2·324	2·625	·722	80·43
91330	29/32	1 3/32	5·564	1·640	2·387	2·687	·749	80·34
94374	15/16	1 1/8	5·697	1·687	2·450	2·750	·777	80·25
97410	31/32	1 5/32	5·830	1·734	2·513	2·812	·804	80·16
100452	1	1 3/16	5·963	1·781	2·576	2·875	·831	80·08
103500	1 1/32	1 7/32	6·097	1·828	2·639	2·937	·859	80·01
106530	1 1/16	1 1/4	6·230	1·875	2·702	3·000	·886	79·93
109567	1 3/32	1 9/32	6·364	1·921	2·765	3·062	·913	79·86
112613	1 1/8	1 5/16	6·499	1·968	2·828	3·125	·941	79·80
115654	1 5/32	1 11/32	6·633	2·015	2·891	3·187	·968	79·74
118691	1 3/16	1 3/8	6·767	2·062	2·955	3·250	·996	79·68

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

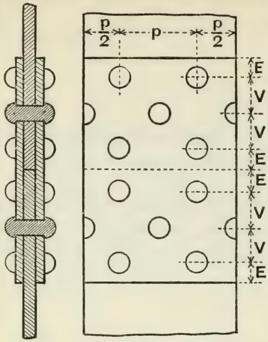
Thickness of Plates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
1/2	47943	49787	51631	53474	55318	57162	59006
17/32	50791	52744	54698	56651	58605	60558	62512
9/16	53640	55703	57767	59830	61893	63956	66019
19/32	56475	58647	60820	62992	65164	67336	69508
5/8	59324	61606	63888	66169	68451	70733	73014
21/32	62160	64551	66942	69332	71723	74114	76505
11/16	64992	67492	69992	72491	74991	77491	79990
23/32	67829	70438	73047	75655	78264	80873	83482
3/4	70665	73383	76101	78818	81536	84254	86972
25/32	73490	76317	79144	81970	84797	87623	90450
13/16	76326	79262	82198	85133	88069	91004	93940
27/32	79154	82198	85243	88287	91331	94376	97420
7/8	81973	85126	88279	91431	94584	97737	100890
29/32	84806	88068	91330	94591	97853	101115	104377
15/16	87633	91003	94374	97744	101115	104485	107856
31/32	90452	93931	97410	100888	104367	107846	111325
1	93276	96864	100452	104039	107627	111214	114802
1 1/32	96107	99803	103500	107196	110892	114589	118285
1 1/16	98920	102725	106530	110334	114139	117943	121748
1 3/32	101740	105653	109567	113480	117393	121306	125219
1 1/8	104569	108591	112613	116634	120656	124678	128700
1 5/32	107393	111523	115654	119784	123915	128045	132176
1 3/16	110213	114452	118691	122929	127168	131407	135646

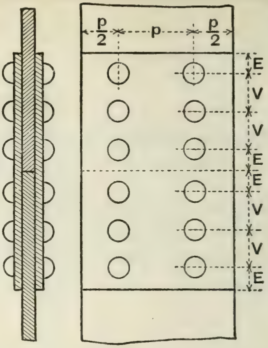
N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

TABLE No. 154.

Treble Riveted Butt Joints. *Zig Zag Riveting.*





Treble Riveted Butt Joints. *Chain Riveting.*

Steel Plates and Steel Rivets.

28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Distance between Rows of Rivets. Chain Riveting.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
51631	1/2	11/16	3·889	1·031	1·738	1·875	·312	82·32
54698	17/32	23/32	4·012	1·078	1·799	1·937	·332	82·08
57767	9/16	3/4	4·137	1·125	1·860	2·000	·351	81·87
60820	19/32	25/32	4·262	1·171	1·921	2·062	·371	81·66
63888	5/8	13/16	4·390	1·218	1·984	2·125	·390	81·49
66942	21/32	27/32	4·518	1·265	2·046	2·187	·410	81·32
69992	11/16	7/8	4·646	1·312	2·109	2·250	·429	81·16
73047	23/32	29/32	4·776	1·359	2·172	2·312	·449	81·02
76101	3/4	15/16	4·906	1·406	2·235	2·375	·468	80·89
79144	25/32	31/32	5·037	1·453	2·298	2·437	·488	80·76
82198	13/16	1	5·168	1·500	2·361	2·500	·507	80·65
85243	27/32	1 1/32	5·300	1·546	2·425	2·562	·527	80·54
88279	7/8	1 1/16	5·432	1·593	2·489	2·625	·546	80·43
91330	29/32	1 3/32	5·564	1·640	2·553	2·687	·566	80·34
94374	15/16	1 1/8	5·697	1·687	2·617	2·750	·585	80·25
97410	31/32	1 5/32	5·830	1·734	2·681	2·812	·605	80·16
100452	1	1 3/16	5·963	1·781	2·745	2·875	·625	80·08
103500	1 1/32	1 7/32	6·097	1·828	2·809	2·937	·644	80·01
106530	1 1/16	1 1/4	6·230	1·875	2·873	3·000	·664	79·93
109567	1 3/32	1 9/32	6·364	1·921	2·937	3·062	·683	79·86
112613	1 1/8	1 5/16	6·499	1·968	3·002	3·125	·703	79·80
115654	1 5/32	1 11/32	6·633	2·015	3·067	3·187	·722	79·74
118691	1 3/16	1 3/8	6·767	2·062	3·131	3·250	·742	79·68

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons, per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

Thickness of Plates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
1/2	47943	49787	51631	53474	55318	57162	59006
17/32	50791	52744	54698	56651	58605	60558	62512
9/16	53640	55703	57767	59830	61893	63956	66019
19/32	56475	58647	60820	62992	65164	67336	69508
5/8	59324	61606	63888	66169	68451	70733	73014
21/32	62160	64551	66942	69332	71723	74114	76505
11/16	64992	67492	69992	72491	74991	77491	79990
23/32	67829	70438	73047	75655	78264	80873	83482
3/4	70665	73383	76101	78818	81536	84254	86972
25/32	73490	76317	79144	81970	84797	87623	90450
13/16	76326	79262	82198	85133	88069	91004	93940
27/32	79154	82198	85243	88287	91331	94376	97420
7/8	81973	85126	88279	91431	94584	97737	100890
29/32	84806	88068	91330	94591	97853	101115	104377
15/16	87633	91003	94374	97744	101115	104485	107856
31/32	90452	93931	97410	100888	104367	107846	111325
1	93276	96864	100452	104039	107627	111214	114802
1 1/32	96107	99803	103500	107196	110892	114589	118285
1 1/16	98920	102725	106530	110334	114139	117943	121748
1 3/32	101740	105653	109567	113480	117393	121306	125219
1 1/8	104569	108591	112613	116634	120656	124678	128700
1 5/32	107393	111523	115654	119784	123915	128045	132176
1 3/16	110213	114452	118691	122929	127168	131407	135646

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

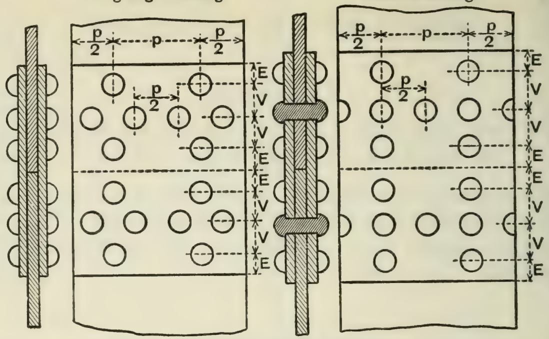
$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

Zig Zag Riveting. Chain Riveting.

TABLE No. 156.

Treble Riveted Double Butt Joints, each alternate

Rivet omitted in the outer and inner rows.



Steel Plates and Steel Rivets.

28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Chain Riveting.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
59736	9/16	11/16	4·482	1·031	1·695	1·940	·351	84·66
62957	19/32	23/32	4·648	1·078	1·764	2·015	·371	84·53
66185	5/8	3/4	4·814	1·125	1·834	2·090	·390	84·42
69403	21/32	25/32	4·981	1·171	1·904	2·166	·410	84·31
72622	11/16	13/16	5·148	1·218	1·974	2·242	·429	84·21
75842	23/32	27/32	5·316	1·265	2·044	2·318	·449	84·12
79064	3/4	7/8	5·485	1·312	2·114	2·394	·468	84·04
82280	25/32	29/32	5·653	1·359	2·184	2·470	·488	83·96
85500	13/16	15/16	5·822	1·406	2·255	2·547	·507	83·89
88715	27/32	31/32	5·991	1·453	2·325	2·623	·527	83·82
91934	7/8	1	6·161	1·500	2·395	2·700	·546	83·76
95150	29/32	1 1/32	6·330	1·546	2·466	2·776	·566	83·70
98372	15/16	1 1/16	6·500	1·593	2·536	2·853	·585	83·65
101590	31/32	1 3/32	6·670	1·640	2·607	2·930	·605	83·60
104805	1	1 1/8	6·840	1·687	2·677	3·007	·625	83·55
108015	1 1/32	1 5/32	7·010	1·734	2·747	3·083	·644	83·50
111235	1 1/16	1 3/16	7·181	1·781	2·818	3·160	·664	83·46
114452	1 3/32	1 7/32	7·351	1·828	2·889	3·237	·683	83·42
117665	1 1/8	1 1/4	7·522	1·875	2·959	3·314	·703	83·38
120876	1 5/32	1 9/32	7·692	1·921	3·030	3·391	·722	83·34
124083	1 3/16	1 5/16	7·863	1·968	3·100	3·468	·742	83·30
127303	1 7/32	1 11/32	8·034	2·015	3·171	3·545	·761	83·27
130520	1 1/4	1 3/8	8·205	2·062	3·242	3·622	·781	83·24

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

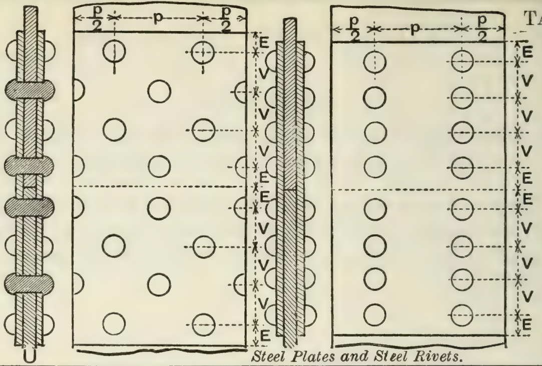
Thickness of Plates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
9/16	55469	57602	59736	61869	64002	66136	68269
19/32	58460	60708	62957	65205	67453	69702	71950
5/8	61457	63821	66185	68548	70912	73276	75640
21/32	64445	66924	69403	71881	74360	76839	79317
11/16	67434	70028	72622	75215	77809	80402	82996
23/32	70424	73133	75842	78550	81259	83967	86676
3/4	73416	76240	79064	81887	84711	87535	90358
25/32	76402	79341	82280	85218	88157	91095	94034
13/16	79392	82446	85500	88553	91607	94660	97714
27/32	82378	85546	88715	91883	95051	98220	101388
7/8	85367	88650	91934	95217	98500	101784	105067
29/32	88353	91751	95150	98548	101946	105344	108742
15/16	91345	94858	98372	101885	105398	108911	112425
31/32	94333	97961	101590	105218	108846	112474	116102
1	97318	101061	104805	108548	112291	116034	119777
1 1/32	100299	104157	108015	111872	115730	119588	123445
1 1/16	103289	107262	111235	115207	119180	123153	127125
1 3/32	106276	110364	114452	118539	122627	126714	130802
1 1/8	109260	113462	117665	121867	126069	130271	134474
1 5/32	112242	116559	120876	125193	129510	133827	138144
1 3/16	115219	119651	124083	128514	132946	137377	141809
1 7/32	118209	122756	127303	131849	136396	140942	145489
1 1/4	121197	125858	130520	135181	139842	144504	149165

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

TABLE No. 158.

Quadruple Riveted Double Butt Joints.
Zig Zag Riveting.



Chain Riveting.

Steel Plates and Steel Rivets.

28 tons D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.	Chain Riveting.	Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V	T_1	
59736	9/16	11/16	4·482	1·031	1·940	1·875	·351	84·66
62957	19/32	23/32	4·648	1·078	2·015	1·937	·371	84·53
66185	5/8	3/4	4·814	1·125	2·090	2·000	·390	84·42
69403	21/32	25/32	4·981	1·171	2·166	2·062	·410	84·31
72622	11/16	13/16	5·148	1·218	2·242	2·125	·429	84·21
75842	23/32	27/32	5·316	1·265	2·318	2·187	·449	84·12
79064	3/4	7/8	5·485	1.312	2·394	2·250	·468	84·04
82280	25/32	29/32	5·653	1·359	2·470	2·312	·488	83·96
85500	13/16	15/16	5·822	1·406	2·547	2·375	·507	83·89
88715	27/32	31/32	5·991	1·453	2·623	2·437	·527	83·82
91934	7/8	1	6·161	1·500	2·700	2·500	·546	83·76
95150	29/32	1 1/32	6·330	1·546	2·776	2·562	·566	83·70
98372	15/16	1 1/16	6·500	1·593	2·853	2·625	·585	83·65
101590	31/32	1 3/32	6·670	1·640	2·930	2·687	·605	83·60
104805	1	1 1/8	6·840	1·687	3·007	2·750	·625	83·55
108015	1 1/32	1 5/32	7·010	1·734	3·083	2·812	·644	83·50
111235	1 1/16	1 3/16	7·181	1·781	3·160	2·875	·664	83·46
114452	1 3/32	1 7/32	7·351	1·828	3·237	2·937	·683	83·42
117665	1 1/8	1 1/4	7·522	1·875	3·314	3·000	·703	83·38
120876	1 5/32	1 9/32	7·692	1·921	3·391	3·062	·722	83·34
124083	1 3/16	1 5/16	7·863	1·968	3·468	3·125	·742	83·30
127303	1 7/32	1 11/32	8·034	2·015	3·545	3·187	·761	83·27
130520	1 1/4	1 3/8	8·205	2·062	3·622	3·250	·781	83·24

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

Thickness of Plates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
9/16	55469	57602	59736	61869	64002	66136	68269
19/32	58460	60708	62957	65205	67453	69702	71950
5/8	61457	63821	66185	68548	70912	73276	75640
21/32	64445	66924	69403	71881	74360	76839	79317
11/16	67434	70028	72622	75215	77809	80402	82996
23/32	70424	73133	75842	78550	81259	83967	86676
3/4	73416	76240	79064	81887	84711	87535	90358
25/32	76402	79341	82280	85218	88157	91095	94034
13/16	79392	82446	85500	88553	91607	94660	97714
27/32	82378	85546	88715	91883	95051	98220	101388
7/8	85367	88650	91934	95217	98500	101784	105067
29/32	88353	91751	95150	98548	101946	105344	108742
15/16	91345	94858	98372	101885	105398	108911	112425
31/32	94333	97961	101590	105218	108846	112474	116102
1	97318	101061	104805	108548	112291	116034	119777
1 1/32	100299	104157	108015	111872	115730	119588	123445
1 1/16	103289	107262	111235	115207	119180	123153	127125
1 3/32	106276	110364	114452	118539	122627	126714	130802
1 1/8	109260	113462	117665	121867	126069	130271	134474
1 5/32	112242	116559	120876	125193	129510	133827	138144
1 3/16	115219	119651	124083	128514	132946	137377	141809
1 7/32	118209	122756	127303	131849	136396	140942	145489
1 1/4	121197	125858	130520	135181	139842	144504	149165

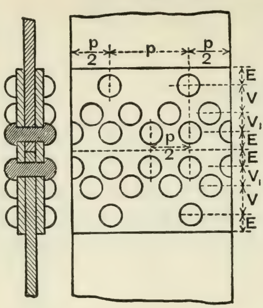
N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

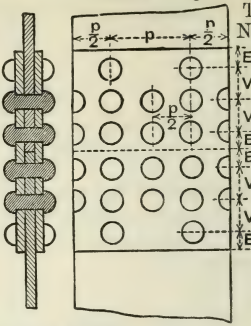
TABLE No. 160.

Treble Riveted Double Butt Joints, each alternate Rivet omitted in the outer row.

Zig Zag Riveting.



Chain Riveting.



Steel Plates and Steel Rivets.

28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.		Chain Riveting.		Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V_1	V	V_1	T_1	
73260	11/16	11/16	4·568	1·031	1·711	1·184	1·969	1·875	·522	84·95
76590	23/32	23/32	4·776	1·078	1·789	1·238	2·059	1·937	·545	84·95
79920	3/4	3/4	4·983	1·125	1·867	1·292	2·148	2·000	·569	84·95
83251	25/32	25/32	5·191	1·171	1·945	1·346	2·237	2·062	·593	84·95
86581	13/16	13/16	5·399	1·218	2·023	1·399	2·327	2·125	·617	84·95
89911	27/32	27/32	5·606	1·265	2·100	1·453	2·416	2·187	·640	84·95
93241	7/8	7/8	5·814	1·312	2·178	1·507	2·506	2·250	·664	84·95
96571	29/32	29/32	6·022	1·359	2·256	1·561	2·596	2·312	·688	84·95
99901	15/16	15/16	6·229	1·406	2·334	1·615	2·685	2·375	·712	84·95
103231	31/32	31/32	6·437	1·453	2·412	1·669	2·775	2·437	·735	84·95
106561	1	1	6·645	1·500	2·490	1·723	2·864	2·500	·759	84·95
109891	1 1/32	1 1/32	6·852	1·546	2·567	1·776	2·954	2·562	·783	84·95
113221	1 1/16	1 1/16	7·060	1·593	2·645	1·830	3·043	2·625	·807	84·95
116551	1 3/32	1 3/32	7·268	1·640	2·723	1·884	3·132	2·687	·830	84·95
119881	1 1/8	1 1/8	7·475	1·687	2·801	1·938	3·222	2·750	·854	84·95
123211	1 5/32	1 5/32	7·683	1·734	2·879	1·992	3·312	2·812	·878	84·95
126541	1 3/16	1 3/16	7·890	1·781	2·956	2·046	3·401	2·875	·901	84·95
129871	1 7/32	1 7/32	8·098	1·828	3·034	2·099	3·491	2·937	·925	84·95
133201	1 1/4	1 1/4	8·306	1·875	3·112	2·153	3·580	3·000	·949	84·95
136531	1 9/32	1 9/32	8·513	1·921	3·190	2·207	3·670	3·062	·973	84·95
139861	1 5/16	1 5/16	8·721	1·968	3·268	2·261	3·759	3·125	·996	84·95
143191	1 11/32	1 11/32	8·929	2·015	3·346	2·315	3·849	3·187	1·020	84·95
146521	1 3/8	1 3/8	9·136	2·062	3·423	2·369	3·938	3·250	1·044	84·95

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

o face page 318.

Table No. 160 *continued* for Plates up to 1⅝ inch thick.

28 tons. D × B × F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets.				Thickness of Butt Straps.	Percentage of Joint.
					Zig Zag Riveting.		Chain Riveting.			
N	T	d	p	E	V	V_1	V_1	V_1	T_1	
49851	1 13/32	1 13/32	9·334	2·109	3·501	2·423	4·028	3·312	1·068	84·95
53181	1 7/16	1 7/16	9·552	2·156	3·579	2·477	4·118	3·375	1·091	84·95
56511	1 15/32	1 15/32	9·769	2·203	3·657	2·530	4·207	3·437	1·115	84·95
59841	1 ½	1 ½	9·967	2·250	3·735	2·584	4·297	3·50	1·139	84·95
62653	1 17/32	1 17/32	10·	2·296	3·779	2·607	4·327	3·562	1·168	84·68
65365	1 9/16	1 9/16	10·	2·343	3·816	2·625	4·346	3·625	1·198	84·37
68052	1 19/32	1 19/32	10·	2·390	3·853	2·642	4·365	3·687	1·229	84·06
70716	1 ⅝	1 ⅝	10·	2·437	3·891	2·659	4·384	3·750	1·260	83·75

To face page 319.

Table No. 161 *continued* for Plates up to 1⅝ inch thick.

Thickness of Plates.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
1 13/32	139148	144499	149851	155203	161555	165937	171259
1 7/16	142240	147711	153181	158652	164123	169594	175064
1 15/32	145332	150922	156511	162101	167691	173281	178870
1 ½	148424	154133	159841	165550	171259	176967	182776
1 17/32	151035	156844	162653	168462	174271	180080	185889
1 9/16	153653	159459	165365	171271	177177	183082	188988
1 19/32	156048	162050	168052	174054	180056	186058	192059
1 ⅝	158522	164619	170716	176813	182910	189007	195104

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

ickness f Plate.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
11/16	68027	70643	73260	75876	78492	81109	83725
23/32	71119	73854	76590	79325	82060	84796	87531
3/4	74211	77065	79920	82774	85628	88482	91337
25/32	77304	80277	83251	86224	89197	92170	95144
13/16	80396	83488	86581	89673	92765	95857	98949
27/32	83488	86699	89911	93122	96333	99544	102755
7/8	86580	89910	93241	96571	99901	103231	106561
29/32	89673	93122	96571	100019	103468	106917	110366
15/16	92765	96333	99901	103468	107036	110604	114172
31/32	95857	99544	103231	106917	110604	114291	117978
	98949	102755	106561	110366	114172	117978	121784
1/32	102041	105966	109891	113815	117740	121665	125589
1/16	105133	109177	113221	117264	121308	125351	129395
3/32	108225	112388	116551	120713	124876	129038	133201
1/8	111318	115599	119881	124162	128443	132725	137006
5/32	114410	118810	123211	127611	132011	136412	140812
3/16	117502	122021	126541	131060	135579	140098	144618
7/32	120594	125232	129871	134509	139147	143785	148424
1/4	123686	128443	133201	137958	142715	147472	152229
9/32	126778	131654	136531	141407	146283	151159	156035
5/16	129870	134865	139861	144856	149851	154846	159841
11/32	132963	138077	143191	148304	153418	158532	163646
3/8	136055	141288	146521	151753	156986	162219	167452

N = Numeral appropriate to the thickness of plate and tensile strength of steel.
B = Working pressure, in pounds, per square inch.
D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F$

FURNACES, PLAIN CYLINDRICAL.

Steel Plates.

The Tables Nos. 162 to 174, immediately following, and Nos. 329 t 341, are only intended for furnaces of ordinary diameters, when th length does not exceed 10 feet, and for the given thickness of plate a the head of the Table. The diameter should never exceed that foun in the column opposite the particular pressure. When A1 is the dis tinguishing letter, Table No. 175 may be used, or No. 342.

By the tables, if the diameter is determined, the length, thickness and pressure can be found; the length can be found if the diamete thickness, and pressure are determined; the pressure can be ascertain if the diameter, thickness, and length are known; and when the di meter, length, and pressure are determined, the required thickness ca be found.

The numerals in each table, under each distinguishing letter, a those applicable to the circumstances of the case to which the lett refers and to the thickness of plate at the head of the table.

The distinguishing letters refer to the method adopted in construc ing the furnaces, as the following will explain :—

Distinguishing Letters.		Distinguishi Letters.
A1.	Longitudinal seams welded, and the furnace *annealed afterwards*, ...	A1.
A.	Longitudinal seams double riveted, single butt straps, and holes *drilled*, ...	A.
A.	Longitudinal seams single riveted, double butt straps, and holes *drilled*, ...	A.
B.	Longitudinal seams double riveted, single butt straps, holes *punched*, and the plates *annealed afterwards*, ...	B.
B.	Longitudinal seams single riveted, double butt straps, holes *punched*, and the plates *annealed afterwards*, ...	B.
C.	Longitudinal seams single riveted, single butt straps, and holes *drilled*, ...	C.
C.	Longitudinal seams double riveted, lap joints bevelled, and holes *drilled*, ...	C.
D.	Longitudinal seams single riveted, single butt straps, holes *punched*, and the plates *annealed afterwards*, ...	D.
D.	Longitudinal seams double riveted, lap joints *not* bevelled, and holes *drilled*, ...	D.
D.	Longitudinal seams double riveted, lap joints bevelled, holes *punched*, and the plates *annealed afterwards*.	D.

Distinguishing Letters.		Distinguishing Letters.
E.	Longitudinal seams single riveted, lap joints bevelled, and holes *drilled*, ...	E.
E.	Longitudinal seams double riveted, lap joints *not* bevelled, holes *punched*, and the plates *annealed afterwards*, ...	E.
F.	Longitudinal seams single riveted, lap joints *not* bevelled, and holes *drilled*, ...	F.
F.	Longitudinal seams single riveted, lap joints bevelled, holes *punched*, and the plates *annealed afterwards*, ...	F.
G.	Longitudinal seams single riveted, lap joints *not* bevelled, holes *punched*, and the plates *annealed afterwards*, ...	G.

Punching the holes is always objectionable, more particularly when the plates are not very thin. If punched, the plates should be annealed before they are bent.

From the foregoing it will be seen that the distinguishing letter A has reference to three different methods of construction, the letter B to two, the letter C to two, the letter D to three, the letter E to two, the letter F to two, and G to one method.

N = Numeral in the table applicable to the method of construction.
L = Length of furnace in feet (for the limits of L, see the first paragraph of these notes).
D = Diameter of furnace, in inches, outside.
B = Working pressure, in lbs. per square inch.

(1) The *maximum* diameter in inches of a *horizontal* furnace for any pressure, if the length of the furnace, the thickness of plate, and pressure be determined, may be found by dividing the numeral in the column applicable to the class of furnace, or method of construction, and opposite the given pressure, by the length of furnace in feet *plus* 1.

Or, the outside diameter in inches should not exceed $\frac{N}{L+1} = D$.

If the thickness of the plates be $\frac{9}{16}$ inch, the length 10 feet, and the pressure 75 lbs., and the *horizontal* furnace is of the description to which the distinguishing letter A is applicable, and it is required to determine the maximum outside diameter :—

Then, in the table for $\frac{9}{16}$ inch steel plates (No. 172), opposite 75 lbs., the pressure, in the column A, applicable to the case, 418, the numeral, is found, and if this be divided by 11, the length in feet *plus* 1, the result is 38, which is the greatest outside diameter in inches the furnace should be,

$$\frac{418}{10+1} = 38 = D.$$

(2) The maximum length in feet of a *horizontal* furnace for any pressure, if the diameter of the furnace and thickness of plate be determined, may be found by dividing the numeral applicable to the class of furnace or method of construction, and opposite the given pressure, by the diameter in inches, and diminishing the result by 1.

Or, the length should not exceed $\frac{N}{D} - 1 = L$.

If the thickness of the steel plates be $7/16$ inch, the outside diameter 30 inches, and the pressure 100 lbs., and the *horizontal* furnace is of the description to which the distinguishing letter A is applicable, and it is required to determine the greatest length:—

Then, in the table for $7/16$ inch steel plates (No. 168), opposite 100 lbs., the pressure in the column A, applicable to the case, 189, the numeral, is found, and if this be divided by 30, the outside diameter, the result is 6·3, which lessened by 1 equals 5·3, which is the greatest length in feet the furnace should be,

$$\text{or} \qquad \frac{189}{30} = 6{\cdot}3$$

$$\text{and} \qquad 6{\cdot}3 - 1 = 5{\cdot}3 = L.$$

(3) The maximum pressure for any *horizontal* furnace, if the diameter of the furnace, the thickness of plate, and the length be known, may be found by multiplying the diameter in inches by the length in feet *plus* 1, the result is the numeral which should be looked for under the distinguishing letter applicable to the class of furnace or method of construction, and opposite the numeral so arrived at the greatest pressure is found, on the left in the first column on the page,

$$\text{or} \qquad D \times (L + 1) = N,$$

and the pressure found on the left of the page opposite the numeral, in the column under the distinguishing letter applicable to the case, is the greatest pressure.

If the thickness of the steel plates be $3/8$ inch, the outside diameter 23 inches, and the length 10 feet, and the furnace is of the description to which the distinguishing letter A is applicable, and the greatest working pressure is required to be determined:—

Then, if 23, the outside diameter, be multiplied by 11, which is the length *plus* 1, the result is 253, the numeral, and in the table for $3/8$ inch plate in column A applicable to the case, opposite 253, on the left of the page, 55 lbs. pressure is found, which is the greatest working pressure,

$$\text{or} \qquad 23 \times (10 + 1) \text{ or } 23 \times 11 = 253 = N,$$

and opposite the numeral 253, the pressure found is 55 lbs. $=$ B.

(4) The minimum thickness of the plate of a *horizontal* furnace, if the pressure, diameter, and length of furnace, and class of furnace or

ıethod of construction be known, may be found by multiplying the iameter in inches by the length in feet *plus* 1, which gives the numeral, 'hich numeral should be looked for *opposite* the pressure in a column f the tables under the distinguishing letter applicable to the class of ırnace, and if such a number is not found, the nearest to it, but not lower number, is the numeral to adopt, and at the head of the table he thickness of plate given is the least thickness,

$$\text{or} \quad D \times (L+1) = N.$$

If the outside diameter of a *horizontal* steel furnace be 40 inches, the ength 7 feet, and the pressure 120 lbs., and the class of furnace is such s the distinguishing letter A refers to, and the *minimum* thickness of late is required:—

Then, if 40, the outside diameter, be multiplied by $7+1=8$, which is the length increased by 1, the result is 320, which is practically the numeral found opposite 120, the pressure, in column A of Table No. 174; the numeral found opposite 120 lbs. only differs by 2, and such difference is of no material consequence. At the head of the table, in which 322 is found, the thickness is ⅝ inch, which is the least thickness the plates should be.

Had the numeral arrived at been much in excess of 322, then the pressure could not be so high as 120 lbs., for the length and diameter stipulated, as the tables do not include plates above ⅝ inch thick; but if the plates had been less than ⅝ inch thick, and the numeral arrived at was in excess of that found opposite the stipulated pressure in one table, then the next higher numeral, found opposite the stipulated pressure, and in a column under the distinguishing letter applicable, in a table for *thicker* plates, is the numeral to be used; for instance, if the numeral arrived at in a case be 125, and in a table opposite the stipulated pressure and under the distinguishing letter applicable to the circumstances of the case, 116 is found, and in the table for next thicker plates, opposite the stipulated pressure, and in the column under the distinguishing letter, the numeral is 136, the thickness at the head of the table in which 136 is found is the required thickness.

Furnaces which are found too weak may be materially strengthened ɔ as to be fit for greater pressures, by fitting rings, as properly fitted ıngs are equivalent to shortening the length.

(5) If a furnace be *vertical*, its diameter should not exceed ·9 of that ıitable for a *horizontal* one of the same dimensions in other respects ıd constructed in the same manner:—

Thus, if 40 inches is the proper diameter for a *horizontal* furnace, then

$$40 \times \cdot 9 = 36 = D.$$

which is the outside diameter the *vertical* furnace should be.

(6) In finding the length of a *vertical* furnace, the appropriate numeral for a *horizontal* one of the same dimensions, and constructed in the same manner, should be multiplied by ·9 :—

Thus, if 322 be the appropriate numeral for a *horizontal* furnace and 40 inches the outside diameter,

$$\text{Then} \quad \frac{\cdot 9 \times 322}{40} - 1 = 6\cdot 245 = L,$$

which is the length the *vertical* furnace should be.

(7) In finding the pressure for a *vertical* furnace, the numeral is found by multiplying the length in feet *plus* 1, by the outside diameter in inches and *dividing* by ·9. Then opposite the numeral will be found the pressure in the same way as for a *horizontal* furnace.

(8) In determining the thickness of a *vertical* furnace, having found the numeral by multiplying the length in feet, *plus* 1, by the diameter in inches, and *dividing* the result by ·9, the nearest numeral (but not a lower one) should be looked for opposite the pressure in the tables, and in the column under the distinguishing letter applicable to the construction of the furnace, and the thickness is that at the head of the table.

When the diameter of a *vertical* furnace does not decrease 1 in 12, instead of using the number ·9 alluded to in the former paragraphs, it should be ·85, and if the furnace is parallel it should not exceed ·8.

FURNACES PLAIN CYLINDRICAL.

Steel Plates $\frac{1}{4}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	248	234	220	206	193	179	165	72
30	206	195	183	172	160	149	138	68·75
35	177	167	157	147	138	128	118	65·13
40	155	146	138	129	120	112	103	61·87
45	138	130	122	115	107	99·3	91·7	55
50	124	117	110	103	96·3	89·4	82·5	49·5
55	113	106	100	93·7	87·5	81·2	75	45
60	103	97·4	91·7	85·9	80·2	74·5	68·8	41·25
65	95·2	89·9	84·6	79·3	74	68·8	63·5	38·07
70	88·4	83·5	78·6	73·7	68·8	63·8	58·9	35·35
75	82·5	77·9	73·3	68·8	64·2	59·6	55	33
80	77·3	73	68·8	64·5	60·2	55·9	51·6	30·93
85	72·8	68·8	64·7	60·7	56·6	52·6	48·5	29·11
90	68·8	64·9	61·1	57·3	53·5	49·7	45·8	27·5
95	65·1	61·5	57·9	54·3	50·7	47	43·4	26·05
100	61·9	58·4	55	51·6	48·1	44·7	41·3	24·75
105	58·9	55·7	52·4	49·1	45·8	42·6	39·3	23·57
110	56·2	53·1	50	46·9	43·7	40·6	37·5	22·5
115	53·8	50·8	47·8	44·8	41·8	38·9	35·9	21·52
120	51·6	48·7	45·8	43	40·1	37·2	34·4	20·62
125	49·5	46·8	44	41·3	38·5	35·8	33	19·8
130	47·6	45	42·3	39·7	37	34·4	31·7	19·3
135	45·8	43·3	40·7	38·2	35·6	33·1	30·6	18·33
140	44·2	41·7	39·3	36·8	34·4	31·9	29·5	17·67
145	42·7	40·3	37·9	35·6	33·2	30·8	28·4	17·06
150	41·3	39	36·7	34·4	32·1	29·8	27·5	16·5
155	39·9	37·7	35·5	33·3	31	28·8	26·6	15·96
160	38·7	36·5	34·4	32·2	30·1	27·9	25·8	15·46

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 1·5 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

Steel Plates $\frac{9}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	261	247	232	218	203	189	174	72
35	224	211	199	186	174	162	149	68·75
40	196	185	174	163	152	141	131	65·13
45	174	164	155	145	135	126	116	61·87
50	157	148	139	131	122	113	104	55·68
55	142	134	127	119	111	103	94·9	50·62
60	131	123	116	109	102	94·3	87	46·4
65	120	114	107	100	93·7	87	80·3	42·83
70	112	106	99·4	93·2	87	80·8	74·6	39·77
75	104	98·6	92·8	87	81·2	75·4	69·6	37·12
80	97·9	92·4	87	81·6	76·1	70·7	65·3	34·8
85	92·1	87	81·9	76·8	71·7	66·5	61·4	32·75
90	87	82·2	77·3	72·5	67·7	62·8	58	30·93
95	82·4	77·9	73·3	68·7	64·1	59·5	55	29·3
100	78·3	74	69·6	65·3	60·9	56·6	52·2	27·84
105	74·6	70·4	66·3	62·2	58	53·9	49·7	26·51
110	71·2	67·2	63·3	59·3	55·4	51·4	47·5	25·31
115	68·1	64·3	60·5	56·7	53	49·2	45·4	24·21
120	65·3	61·6	58	54·4	50·8	47·1	43·5	23·2
125	62·6	59·2	55·7	52·2	48·7	45·2	41·8	22·27
130	60·2	56·9	53·5	50·2	46·9	43·5	40·2	21·41
135	58	54·8	51·6	48·3	45·1	41·9	38·7	20·62
140	55·9	52·8	49·7	46·6	43·5	40·4	37·3	19·88
145	54	51	48	45	42	39	36	19·2
150	52·2	49·3	46·4	43·5	40·6	37·7	34·8	18·56
155	50·5	47·7	44·9	42·1	39·3	36·5	33·7	17·96
160	48·9	46·2	43·5	40·8	38·1	35·3	32·6	17·4

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 1·812 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL.

Table No. 164.

Steel Plates $\frac{5}{16}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	..	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	276	261	246	230	215	199	184	72
40	242	228	215	201	188	175	161	68·75
45	215	203	191	179	167	155	143	65·13
50	193	183	172	161	150	140	129	61·87
55	176	166	156	146	137	127	117	56·25
60	161	152	143	134	125	116	107	51·56
65	149	140	132	124	116	107	99·2	47·59
70	138	130	123	115	107	99·7	92·1	44·19
75	129	122	115	107	100	93·1	85·9	41·25
80	121	114	107	101	94	87·3	80·6	38·67
85	114	107	101	94·8	88·5	82·1	75·8	36·39
90	107	101	95·5	89·5	83·5	77·6	71·6	34·37
95	102	96·1	90·5	84·8	79·2	73·5	67·8	32·56
100	96·7	91·3	85·9	80·6	75·2	69·8	64·5	30·93
105	92·1	87	81·8	76·7	71·6	66·5	61·4	29·46
110	87·9	83	78·1	73·2	68·4	63·5	58·6	28·12
115	84·1	79·4	74·7	70·1	65·4	60·7	56	26·90
120	80·6	76·1	71·6	67·1	62·7	58·2	53·7	25·78
125	77·3	73	68·8	64·5	60·2	55·9	51·6	24·75
130	74·4	70·2	66·1	62	57·8	53·7	49·6	23·79
135	71·6	67·6	63·7	59·7	55·7	51·7	47·7	22·91
140	69·1	65·2	61·4	57·5	53·7	49·9	46	22·09
145	66·7	63	59·3	55·6	51·9	48·2	44·4	21·33
150	64·5	60·9	57·3	53·7	50·1	46·5	43	20·62
155	62·4	58·9	55·4	52	48·5	45	41·6	19·95
160	60·4	57·1	53·7	50·4	47	43·6	40·3	19·33

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 2·125 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L$. $\frac{N}{L+1} = D$. $(L+1)\ D = N$.

FURNACES PLAIN CYLINDRICAL.

Steel Plates $\frac{11}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	292	276	260	244	227	211	195	72
45	260	246	231	217	202	188	173	68·75
50	234	221	208	195	182	169	156	65·13
55	213	201	189	177	165	154	142	61·87
60	195	184	173	162	152	141	130	56·71
65	180	170	160	150	140	130	120	52·35
70	167	158	149	139	130	121	111	48·61
75	156	147	139	130	121	113	104	45·37
80	146	138	130	122	114	106	97·5	42·53
85	138	130	122	115	107	99·4	91·7	40·03
90	130	123	116	108	101	93·9	86·7	37·81
95	123	116	109	103	95·8	88·9	82·1	35·82
100	117	110	104	97·5	91	84·5	78	34·03
105	111	105	99	92·8	86·7	80·5	74·3	32·41
110	106	100	94·5	88·6	82·7	76·8	70·9	30·93
115	102	96·1	90·4	84·8	79·1	73·5	67·8	29·59
120	97·5	92·1	86·7	81·2	75·8	70·4	65	28·35
125	93·6	88·4	83·2	78	72·8	67·6	62·4	27·22
130	90	85	80	75	70	65	60	26·17
135	86·7	81·8	77	72·2	67·4	62·6	57·8	25·2
140	83·6	78·9	74·3	69·6	65	60·3	55·7	24·3
145	80·7	76·2	71·7	67·2	62·7	58·3	53·8	23·46
150	78	73·7	69·3	65	60·7	56·3	52	22·68
155	75·5	71·3	67·1	62·9	58·7	54·5	50·3	21·95
160	73·1	69·1	65	60·9	56·9	52·8	48·7	21·26

The length L should never exceed 10 ft. and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 2·437 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL.

Steel Plates $\frac{3}{8}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	309	292	275	258	241	223	206	72
50	278	263	248	232	217	201	186	68·78
55	253	239	225	211	197	183	169	65·13
60	232	219	206	193	180	168	155	61·87
65	214	202	190	178	167	155	143	57·11
70	199	188	177	166	155	144	133	53·03
75	186	175	165	155	144	134	124	49·5
80	174	164	155	145	135	126	116	46·4
85	164	155	146	136	127	118	109	43·67
90	155	146	138	129	120	112	103	41·25
95	147	138	130	122	114	106	97·7	39·07
100	139	131	124	116	108	101	92·8	37·12
105	133	125	118	110	103	95·8	88·4	35·35
110	127	120	113	105	98·4	91·4	84·4	33·75
115	121	114	108	101	94·2	87·4	80·7	32·28
120	116	110	103	96·7	90·2	83·8	77·3	30·93
125	111	105	99	92·8	86·6	80·4	74·3	29·7
130	107	101	95·2	89·2	83·3	77·3	71·4	28·55
135	103	97·4	91·7	85·9	80·2	74·5	68·8	27·5
140	99·4	93·9	88·4	82·9	77·3	71·8	66·3	26·51
145	96	90·7	85·3	80	74·7	69·3	64	25·6
150	92·8	87·7	82·5	77·3	72·2	67	61·9	24·75
155	89·8	84·8	79·8	74·8	69·9	64·9	59·9	23·95
160	87	82·2	77·3	72·5	67·7	62·8	58	23·2

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 2·75 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

Steel Plates $\frac{13}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	..
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	..	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	327	309	290	272	254	236	218	72
55	297	281	264	248	231	215	198	68·75
60	272	257	242	227	212	197	182	65·13
65	251	237	223	209	196	182	168	61·17
70	233	220	207	195	182	169	156	57·45
75	218	206	194	182	169	157	145	53·62
80	204	193	182	170	159	148	136	50·27
85	192	182	171	160	150	139	128	47·31
90	182	171	161	151	141	131	121	44·68
95	172	162	153	143	134	124	115	42·33
100	163	154	145	136	127	118	109	40·21
105	156	147	138	130	121	112	104	38·3
110	149	140	132	124	116	107	99	36·56
115	142	134	126	118	111	103	94·7	34·97
120	136	129	121	113	106	98·3	90·8	33·51
125	131	123	116	109	102	94·4	87·1	32·17
130	126	119	112	105	97·8	90·8	83·8	30·93
135	121	114	108	101	94·1	87·4	80·7	29·79
140	117	110	104	97·3	90·8	84·3	77·8	28·72
145	113	106	100	93·9	87·6	81·4	75·1	27·73
150	109	103	96·8	90·8	84·7	78·7	72·6	26·81
155	105	99·6	93·7	87·8	82	76·1	70·3	25·94
160	102	96·4	90·8	85·1	79·4	73·8	68·1	25·13

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 3·062 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L$. $\frac{N}{L+1} = D$. $(L+1)\ D = N$.

FURNACES PLAIN CYLINDRICAL.

Table No. 168.

Steel Plates $\frac{7}{16}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	..	...	...
45	...	...	...	...	...	..	...	...
50	...	...	...	...	...	...	...	...
55	345	325	306	287	268	249	230	72
60	316	298	281	263	246	228	211	68·75
65	292	275	259	243	227	211	194	65·13
70	271	256	241	226	211	196	180	61·87
75	253	239	225	211	197	182	168	57·75
80	237	224	211	197	184	171	158	54·14
85	223	211	198	186	173	161	149	50·95
90	211	199	187	175	164	152	140	48·12
95	199	188	177	166	155	144	133	45·59
100	189	179	168	158	147	137	126	43·31
105	180	170	160	150	140	130	120	41·25
110	172	163	153	144	134	124	115	39·37
115	165	156	146	137	128	119	110	37·66
120	158	149	140	132	123	114	105	36·09
125	152	143	135	126	118	109	101	34·65
130	146	138	130	121	113	105	97·2	33·31
135	140	133	125	117	109	101	93·6	32·08
140	135	128	120	113	105	97·8	90·2	30·93
145	131	123	116	109	102	94·4	87·1	29·87
150	126	119	112	105	98·3	91·2	84·2	28·87
155	122	115	109	102	95·1	88·3	81·5	27·94
160	118	112	105	98·7	92·1	85·5	79	27·07

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 3·375 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

Steel Plates $\frac{15}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	363	342	322	302	282	262	242	72
65	335	316	297	279	260	242	223	68·75
70	311	293	276	259	242	224	207	65·13
75	290	274	258	242	226	209	193	61·87
80	272	257	242	227	211	196	181	58
85	256	242	227	213	199	185	171	54·59
90	242	228	215	201	188	175	161	51·56
95	229	216	204	191	178	165	153	48·84
100	218	205	193	181	169	157	145	46·4
105	207	196	184	173	161	150	138	44·19
110	198	187	176	165	154	143	132	42·18
115	189	179	168	158	147	137	126	40·35
120	181	171	161	151	141	131	121	38·67
125	174	164	155	145	135	126	116	37·12
130	167	158	149	139	130	121	112	35·69
135	161	152	143	134	125	116	107	34·37
140	155	147	138	129	121	112	104	33·14
145	150	142	133	125	117	108	100	32
150	145	137	129	121	113	105	96·7	30·93
155	140	133	125	117	109	101	93·6	29·93
160	136	128	121	113	106	98·2	90·6	29

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 3·687 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL.

TABLE No. 170.

Steel Plates ½ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	..
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
65	381	360	338	317	296	275	254	72
70	354	334	314	295	275	255	236	68·75
75	330	312	293	275	257	238	220	65·13
80	309	292	275	258	241	223	206	61·87
85	291	275	259	243	226	210	194	58·23
90	275	260	244	229	214	199	183	55
95	261	246	232	217	203	188	174	52·1
100	248	234	220	206	193	179	165	49·5
105	236	223	210	196	183	170	157	47·14
110	225	213	200	187	175	162	150	45
115	215	203	191	179	167	155	143	43·04
120	206	195	183	172	160	149	138	41·25
125	198	187	176	165	154	143	132	39·6
130	190	180	169	159	148	138	127	38·07
135	183	173	163	153	143	132	122	36·66
140	177	167	157	147	138	128	118	35·35
145	171	161	152	142	133	123	114	34·13
150	165	156	147	138	128	119	110	33
155	160	151	142	133	124	115	106	31·93
160	155	146	138	129	120	112	103	30·93

The length L should never exceed 10 ft., and $\frac{N}{D}-1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 4 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D}-1=L.$ $\frac{N}{L+1}=D.$ $(L+1)\ D=N.$

Steel Plates $\frac{17}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...
70	399	377	355	333	310	288	266	72
75	373	352	331	310	290	269	248	68·75
80	349	330	310	291	272	252	233	65·13
85	329	310	292	274	256	237	219	61·87
90	310	293	276	259	241	224	207	58·43
95	294	278	261	245	229	212	196	55·36
100	279	264	248	233	217	202	186	52·59
105	266	251	237	222	207	192	177	50·08
110	254	240	226	212	198	183	169	47·81
115	243	229	216	202	189	175	162	45·73
120	233	220	207	194	181	168	155	43·82
125	224	211	199	186	174	161	149	42·07
130	215	203	191	179	167	155	143	40·45
135	207	195	184	172	161	149	138	38·95
140	200	188	177	166	155	144	133	37·56
145	193	182	171	161	150	139	128	36·27
150	186	176	166	155	145	135	124	35·06
155	180	170	160	150	140	130	120	33·93
160	175	165	155	146	136	126	116	32·87

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 4·312 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL.

Table No. 172.

Steel Plates $\frac{9}{16}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...
75	418	394	371	348	325	302	278	72
80	392	370	348	326	305	283	261	68·75
85	369	348	328	307	287	266	246	65·13
90	348	329	309	290	271	251	232	61·87
95	330	311	293	275	256	238	220	58·61
100	313	296	278	261	244	226	209	55·68
105	298	282	265	249	232	215	199	53·03
110	285	269	253	237	221	206	190	50·62
115	272	257	242	227	212	197	182	48·42
120	261	247	232	218	203	189	174	46·4
125	251	237	223	209	195	181	167	44·55
130	241	228	214	201	187	174	161	42·83
135	232	219	206	193	180	168	155	41·25
140	224	211	199	186	174	162	149	39·77
145	216	204	192	180	168	156	144	38·4
150	209	197	186	174	162	151	139	37·12
155	202	191	180	168	157	146	135	35·92
160	196	185	174	163	152	141	131	34·8

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 4·625 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

FURNACES PLAIN CYLINDRICAL.

Steel Plates $\frac{19}{32}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...
75	...	...	...	...	...	...	...	...
80	436	412	388	364	339	315	291	72
85	411	388	365	342	319	297	274	68·75
90	388	366	345	323	302	280	259	65·13
95	367	347	327	306	286	265	245	61·87
100	349	330	310	291	271	252	233	58·78
105	332	314	295	277	259	240	222	55·98
110	317	300	282	264	247	229	212	53·43
115	303	287	270	253	236	219	202	51·11
120	291	275	259	242	226	210	194	48·98
125	279	264	248	233	217	202	186	47·02
130	268	254	239	224	209	194	179	45·21
135	259	244	230	215	201	187	172	43·54
140	249	235	222	208	194	180	166	41·98
145	241	227	214	201	187	174	160	40·53
150	233	220	207	194	181	168	155	39·18
155	225	213	200	188	175	163	150	37·92
160	218	206	194	182	170	158	145	36·73

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.*

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 4·937 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L$. $\frac{N}{L+1} = D$. $(L+1)\,D = N$.

FURNACES PLAIN CYLINDRICAL.

Steel Plates $\frac{5}{8}$ inch thick.

Pressures and Numerals for Lengths and Diameters.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
5	...	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...	...
60	...	...	...	...	...	...	...	...
65	...	...	...	...	...	...	...	...
70	...	...	...	...	...	...	...	...
75	...	...	...	...	...	...	...	...
80	...	...	...	...	...	...	...	...
85	455	430	404	379	354	329	303	72
90	430	406	382	358	334	310	286	68·75
95	407	384	362	339	317	294	271	65·13
100	387	365	344	322	301	279	258	61·87
105	368	348	327	307	286	266	246	58·92
110	352	332	313	293	273	254	234	56·25
115	336	318	299	280	262	243	224	53·80
120	322	304	286	269	251	233	215	51·56
125	309	292	275	258	241	223	206	49·5
130	297	281	264	248	231	215	198	47·59
135	286	271	255	239	223	207	191	45·83
140	276	261	246	230	215	199	184	44·19
145	267	252	237	222	207	193	178	42·67
150	258	243	229	215	201	186	172	41·25
155	249	236	222	208	194	180	166	39·91
160	242	228	215	201	188	175	161	38·67

The length L should never exceed 10 ft., and $\frac{N}{D} - 1$ should not be more than 10 ft.

* The diameter D should not be greater for any given pressure than that opposite the given pressure in this table, but *may be less*.

† When A1 is the distinguishing letter, Table No. 175 may be used when the length does not exceed 5·25 feet; above 160 lbs., see Table No. 342.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N$

FURNACES WITH FLANGED JOINTS.

Steel Plates from ¼ inch to ⅝ inch thick.

Table No. 175, immediately following, and No. 342 are only for furnaces made of rings welded longitudinally and flanged at the *ends*, and, when there is more than one ring, riveted together so as to form a complete furnace, and for furnaces whose length is equal to or shorter than that given opposite the thickness being dealt with, and found in the column "Maximum Lengths for Thickness."

The Table which immediately follows, and Table No. 342 are only for furnaces when the length or the distance between the centres of flanges of the rings, when they are made of more than one ring, does not exceed that given in the column headed "Maximum Lengths for Thickness;" but when the length or the distance between the rings exceeds that given, the pressure or other particulars should be found from the Tables Nos. 162 to 174, or Nos. 329 to 341.

N = Numeral for pressure.
C = Constant for thickness.
D = Diameter of furnace, in inches, outside.
l = Length or distance between centres of flanges, in inches.
B = Working pressure, in lbs. per square inch.

$$\frac{C - l}{N} = D.$$

$$C - ND = l.$$

$$ND + l = C.$$

$$\frac{C - l}{D} = N.$$

(1) The maximum diameter a furnace should be for a given working pressure, if the thickness of steel plate and the length or the distance, in inches, between the centres of the flanges be known, may be found by subtracting the length or the distance between the centres of flanges, in *inches*, from the thickness constant opposite the *given* thickness, and dividing the result by the numeral opposite the *given* pressure; or, the diameter should not exceed $\frac{C - l}{N}$.

If the thickness of the steel plates of a furnace be $^9/_{16}$ inch, the length or the distance between the centres of flanges 24 inches, and the pressure required 150 lbs., and the maximum diameter has to be determined:—

Then, if 24, the length or distance, in inches, between the centres of flanges be subtracted from 156·75, the constant found opposite the thickness, and the remainder divided by 2·7272, the

numeral found opposite the pressure, 150, the result is the maximum outside diameter the furnace should be,

$$\text{or} \quad \frac{156{\cdot}75 - 24}{2{\cdot}7272} = 48{\cdot}67 = D.$$

or, say, $48\frac{5}{8}$ inches.

(2) The maximum length or the distance, in inches, between the centres of the flanges of a furnace can be determined if the working pressure, thickness of steel plates, and diameter are known, by multiplying the numeral opposite the given pressure by the diameter, and subtracting the product from the thickness constant opposite the given thickness; or the length, or distance, in inches, between the centres of flanges should not exceed $C - ND$.

If the working pressure is required to be 150 lbs., the thickness of the steel plate $\frac{9}{16}$ inch, and the outside diameter $48\frac{5}{8}$ inches, and the maximum length, or distance, in inches, between the centres of flanges has to be determined :—

Then, if 2·7272, the numeral found opposite the pressure, 150, be multiplied by 48·625, the diameter, and the product subtracted from 156·75, the constant found opposite the thickness, $\frac{9}{16}$, the remainder is the maximum length, or distance, in inches, between the centres of the flanges,

$$\text{or} \quad 2{\cdot}7272 \times 48{\cdot}625 = 132{\cdot}61,$$

$$\text{and} \quad 156{\cdot}75 - 132{\cdot}61 = 24{\cdot}1 = l,$$

or the maximum length should be, say, 24 inches.

(3) The minimum thickness of steel plates of a furnace can be determined if the working pressure, diameter, and length, or distance, in inches, between the centres of the flanges be known, by adding the length or distance, in inches, between the centres of the flanges to the product of the diameter and the numeral opposite the given pressure; or the thickness constant should not exceed $ND + l$.

If the working pressure is required to be 150 lbs., the outside diameter $48\frac{5}{8}$ inches, and the length, or distance between the centres of flanges, 24 inches, and the minimum thickness of the steel plate has to be determined :—

Then, if 24, the length, be added to the product of 2·7272, the numeral found opposite 150, the working pressure, and 48·625, the diameter, the result is 156·61, which is practically the constant found opposite $\frac{9}{16}$, the thickness,

$$\text{or} \quad 2{\cdot}7272 \times 48{\cdot}625 + 24 = 156{\cdot}61 = C.$$

which gives $\frac{9}{16}$ inch, the thickness of the plate.

(4) The working pressure for a furnace made of steel plates, if the thickness, diameter, and length, or distance, in inches, between the

centres of the flanges is known, may be found opposite the numeral obtained by subtracting the length, in inches, from the thickness constant opposite the given thickness, and dividing by the diameter; or the numeral should not be greater than $\frac{C - l}{D}$.

If the thickness of the steel plate be ⅝ inch, the outside diameter 48 inches, and the length or distance between the centres of the flanges 18 inches, and the working pressure is required to be determined:—

Then, if 18, the length or distance, in inches, between the centres of the flanges, be subtracted from 175·5, the constant opposite ⅝, the thickness, and the remainder divided by 48, the diameter, the result is the numeral opposite which the working pressure is found,

$$\text{or} \quad 175{\cdot}5 - 18 = 157{\cdot}5$$

$$\text{and} \quad \frac{157{\cdot}5}{48} = 3{\cdot}28 = N.$$

and opposite the numeral 3·27, which is practically 3·28, the pressure is 180 = B.

When furnaces are made with flanged joints, it is well to have the radius of the flange on the fire side about 1·5 inch.

The flanges should be kept as near the original thickness of the plate as is practicable, and after all heating, welding, and flanging are completed, the lengths should be efficiently annealed before being riveted. If there are any signs of defects in the flanging, the defective length should not on any account be used.

The distance between the edges of the rivet holes and the edges of the flange should not be less than the diameter of the rivet. The rivets should be of good size, the diameter at least ⅜ inch more than the thickness of the plates, and the heads should not be too large. The depth of the strip or ring between the flanges should not be less than three times the diameter of the rivets, and the thickness may be about one-half the thickness of the furnace plates. To make a first-class job the ring should be turned.

The holes in the flanges should be drilled, but when not drilled in place they should be drilled sufficiently less in diameter to ensure that, when rimered out, fair and perfect holes are formed. It is advisable to have a little taper in the holes in each flange; this will allow the heads of the rivets to be kept of moderate size.

So long as the pressure and diameter remain the same, then for every thirty-second of an inch the plate is increased in thickness, the length between the centres of the flanges may be increased about 9⅜ inches. For *maximum* lengths see Tables Nos. 175 and 342.

Furnaces with flanged joints, or those well known as Adamson's joints or seams, or sometimes as "coxcomb" joints, are by no means a new idea, as they have for a long period been used successfully in

land boilers, but to a more limited extent in marine boilers than they might have been with advantage. It is not improbable, with the improved appliances now available for making these joints, more particularly when good mild steel plates are used, that they may in the future be more frequently seen in modern marine boilers constructed for high pressures, although it is not known that they are the favourite furnace for marine boilers at present, except with one well-known firm of Marine Engineers, and in the opinion of that firm they are the best description of furnace that can be adopted. Whether this be so or not, they are worthy of being considered one of the descriptions of furnaces which, if properly constructed and well made, are serviceable in the modern high pressure marine boiler, and had they been more generally used in land boilers there would have been fewer collapses of furnaces.

Since the foregoing was written, the use of furnaces with flanged joints has very greatly increased, both in marine and land boilers, as was anticipated. Several makers have got special flanging machines. A length can be heated and flanged at both ends easily in forty minutes or even in less time, more particularly when the plates are not thick. Furnaces made as stipulated for in the preceding notes have given every satisfaction.

The Table which follows is only intended for furnaces which are flanged by a suitable machine, and one flange completed at one heat.

FURNACES WITH FLANGED JOINTS.

Steel Plates from $\frac{1}{4}$ inch to $\frac{5}{8}$ inch thick.

Pressure per sq. in.	† Pressure Numerals.	Constants and Maximum Lengths for the Thicknesses which they are opposite.		
lbs.	N.	Thickness.	Constants.	*Maximum Lengths for Thickness in inches.
5	...			
10	...			
15	...			
20	...			
25	...	Inches.	C	
30	...			
35	...	¼	63·0	18·0
40	...			
45	·8181818	9/32	72·375	21·75
50	·9090909			
55	1·0	5/16	81·75	25·50
60	1·0909090			
65	1·1818181	11/32	91·125	29·25
70	1·2727272			
75	1·3636363	⅜	100·50	33·0
80	1·4545454			
85	1·5454545	13/32	109·875	36·75
90	1·6363636			
95	1·7272727	7/16	119·25	40·50
100	1·8181818			
105	1·9090909	15/32	128·625	44·25
110	2·0			
115	2·0909090	½	138·	48·0
120	2·1818181			
125	2·2727272	17/32	147·375	51·75
130	2·3636363			
135	2·4545454	9/16	156·75	55·50
140	2·5454545			
145	2·6363636	19/32	166·125	59·25
150	2·7272727			
155	2·8181818	⅝	175·50	63·0
160	2·9090909			

* The lengths opposite the thickness in each case are the maximum lengths, in inches, between the centres of the flanges, for which the Tables should be used. When the length exceeds that opposite the given thickness then the pressure may be found from the Tables Nos. 162 to 174.

N = Pressure numeral. C = Thickness constant. D = Diameter, outside, in inches.
l = Length between centres of flanges, in inches. † Above 160 lbs., see Table 342.

$$\frac{C-l}{N} = D \qquad C-ND = l \qquad ND+l = C. \qquad \frac{C-l}{D} = N$$

FURNACES, CORRUGATED, CYLINDRICAL.

Steel plates from ¼ inch to ⅝ inch thick.

By the Tables Nos. 176 to 177, immediately following, and No. 343, the maximum diameter, the working pressure, and the thickness of the plate can be determined when the plates of which the furnaces are made are of the best mild steel.

The tables are only intended for furnaces which are machine made, and the pitch of the corrugations 6 inches, the depth from top of corrugation outside to bottom of corrugation inside not less than 2 inches, and the plain parts at the ends not more than 6 inches in length. When the corrugations are not made by machine, the working pressure should be less than that found by the tables, as furnaces, when they are not corrugated by a machine, are not so reliable.

The diameter for the purpose of determining the pressure or thickness is the outside diameter, measured from the bottom of the corrugations; or, the minimum diameter inside, *plus* twice the thickness of the plate.

D = Diameter outside, in inches at the bottom of the corrugations.
T = Thickness, in inches.
B = Working pressure in lbs. per square inch.

The maximum diameter, in inches, to which a corrugated furnace should be made, if constructed of the best mild steel plates, if the thickness of the plate and the working pressure be determined, is found in the column under the given thickness of plate and opposite the given pressure; or if the pressure and diameter be determined, the thickness the plate should be is found at the head of the column above the given diameter, which is found opposite the given pressure; or the pressure for a given thickness and diameter is that opposite the given diameter, which is in the column under the given thickness.

If the pressure is required to be 160 lbs. and the thickness of the steel plate is $^9/_{16}$ inch, and the diameter is required :—

Then, opposite 160 lbs., the pressure, and in the column under $^9/_{16}$ inch, the thickness, 49·21 is found, which is the diameter in inches, or say

$$49\tfrac{1}{4} = D.$$

If the pressure is required to be 160 lbs., and the diameter 43·75 inches, and the thickness of the steel plate has to be determined :—

Then, opposite 160 lbs., the pressure, 43·71, the diameter, is

found (say 43¾) in the column under ½ inch, which is the minimum thickness the steel plate should be,

½ inch = T.

If the working pressure has to be determined when the thickness of the steel plate is ⅝ inch, and the mean diameter 43·75 inches :—

Then, in the column under ⅝ inch, the thickness, 43·75, the diameter, is found, and opposite it the pressure is 200 lbs., which is the maximum working pressure in lbs.,

200 = B.

The corrugated furnace to which these remarks refer is generally known as Fox's furnace, and it has been very extensively used for a good many years. When pressures in *marine* boilers were getting up to about, say, 100 lbs., these furnaces were launched into the market with considerable success, and became the furnace generally fitted in marine boilers, when high pressures were required ; and, as the pressures gradually crept up to what they now are, this furnace has kept its own against other descriptions, and it may be considered to have had its share of patronage ; but while the corrugated furnace has decided advantages over others, had not the manufacturers wisely taken to making it of steel, the corrugated furnace would never have become so universally adopted. Up to this time, it is not known that any serious casualty has resulted from the collapse of a corrugated furnace, although some may have "come down ;" but when this has been the case, the plates have, it is believed, always been overheated, due to dirt or other easily assigned cause, not attributable to defects in the furnace ; and such deformations as have taken place would have been of a much more serious nature, had the furnace been plain instead of corrugated. The furnace is well known, and Samson Fox, the patentee, may well be contented with the success he has achieved in reputation, and probably in a pecuniary sense ; nevertheless, it is thought that there is still sufficient vitality in the Fox corrugated furnace to enable it to compete successfully with any that may come into the market against it.

FURNACES, CORRUGATED, CYLINDRICAL.

Steel Plates from ¼ inch to 7/16 inch thick.
Pressures and Diameters when *Machine* made.

Pressure per square inch.	Thicknesses and Diameters.*						
	¼ in.	9/32 in.	5/16 in.	11/32 in.	⅜ in.	13/32 in.	7/16 in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs.							
5	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...
60	58·33	...	...	...	...	...	...
65	53·84	...	...	...	...	...	...
70	50·0	56·25	...	...	...	...	...
75	46·66	52·50	58·33	...	...	...	...
80	43·75	49·21	54·68	...	...	...	...
85	41·17	46·32	51·47	56·61	...	...	...
90	38·88	43·75	48·61	53·47	58·33	...	...
95	36·84	41·44	46·05	50·65	55·26	...	...
100	35·0	39·37	43·75	48·12	52·50	56·87	...
105	33·33	37·50	41·66	45·83	50·0	54·16	58·33
110	31·81	35·79	39·77	43·75	47·72	51·70	55·68
115	30·43	34·23	38·04	41·84	45·65	49·45	53·26
120	29·16	32·81	36·45	40·10	43·75	47·39	51·04
125	28·0	31·50	35·0	38·50	42·0	45·50	49·0
130	26·92	30·28	33·65	37·01	40·38	43·75	47·11
135	25·92	29·16	32·40	35·64	38·88	42·12	45·37
140	25·0	28·12	31·25	34·37	37·50	40·62	43·75
145	24·13	27·15	30·17	33·18	36·20	39·22	42·24
150	23·33	26·25	29·16	32·08	35·0	37·91	40·83
155	22·58	25·40	28·22	31·04	33·87	36·69	39·51
160	21·87	24·60	27·34	30·07	32·81	35·54	38·28

* The diameter is that measured at the bottom of the corrugations outside.

Steel Plates from $^{15}/_{32}$ inch to $\frac{5}{8}$ inch thick.
Pressures and Diameters when *Machine* made.

Pressure per square inch.	Thicknesses and Diameters.*					
	$^{15}/_{32}$ in.	$\frac{1}{2}$ in.	$^{17}/_{32}$ in.	$^{9}/_{16}$ in.	$^{19}/_{32}$ in.	$\frac{5}{8}$ in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs.						
5	...	...	...	...	...	...
10	...	...	...	...	...	...
15	...	...	...	...	...	...
20	...	...	...	...	...	...
25	...	...	...	...	...	...
30	...	...	...	...	...	...
35	...	...	...	...	...	...
40	...	...	...	...	...	...
45	...	...	...	...	...	...
50	...	...	...	...	...	...
55	...	...	...	...	...	...
60	...	...	...	...	...	...
65	...	...	...	...	...	...
70	...	...	...	...	...	...
75	...	...	...	...	...	...
80	...	...	...	...	...	...
85	...	...	...	...	...	...
90	...	...	...	...	...	...
95	...	...	...	...	...	...
100	...	...	...	...	...	...
105	...	...	...	...	...	...
110	...	...	...	...	...	...
115	57·06	...	...	...	...	...
120	54·68	58·83	...	...	...	...
125	52·50	56·0	...	...	...	...
130	50·48	53·84	57·21	...	...	...
135	48·61	51·85	55·09	58·33	...	...
140	46·87	50·0	53·12	56·25	...	...
145	45·25	48·27	51·29	54·31	57·32	...
150	43·75	46·66	49·58	52·50	55·41	58·33
155	42·33	45·16	47·98	50·80	53·62	56·45
160	41·01	43·71	46·48	49·21	51·95	54·68

* The diameter is that measured at the bottom of the corrugations outside.

FURNACES WITH RIBBED PROJECTIONS, GROOVED INSIDE.*

Steel Plates from ¼ inch to ⅝ inch thick.

By the Tables No. 178 and 179 which immediately follow, and No. 144, the maximum diameter, the working pressure, and the thickness of plate can be determined when the furnace is cylindrical throughout its *whole* length and the plate is of the best mild steel.

The tables are only intended for furnaces when the ribs and grooves are formed by rolling and when the height of the ribs is not less than 1 5/16 inch above the plain part, the depth of the grooves not more than ¾ inch, the length between the centres of the ribs not over 9 inches, and the length of the plain parts at the ends not more than 6 inches. The ends are rolled slightly thicker than the plain parts between the ribs.

The diameter for the purpose of determining the pressure is the outside diameter, measured over the plain parts between the centre of the ribs, or projections ; or the inside diameter of the plain parts *plus* twice the thickness of the plain parts.

D = Diameter, in inches.
T = Thickness of plate, in inches.
B = Working pressure, in lbs. per square inch.

The maximum outside diameter, in inches, which a ribbed and grooved furnace should be when made of mild steel plate of the best quality if the thickness and pressure be determined, is found in the column under the thickness of plate and opposite the given working pressure ; or if the pressure and diameter be determined, the thickness to which the plate should be made is found at the head of the column above the given diameter which is found opposite the given pressure; or the pressure for a given thickness and a given diameter is that opposite the given diameter which is in the column under the given thickness.

If the pressure is required to be 150 lbs. and the thickness of the plates 9/16 inch, and the outside diameter has to be determined :—

Then, opposite 150 lbs., the pressure, and in the column under 9/16 inch, the thickness, 52·5 is found, which is the maximum diameter, in inches,

$$52\tfrac{1}{2} = D.$$

If the pressure is required to be 155 lbs., and the diameter outside 45⅛ inches, and the thickness the plate should be has to be determined :—

Then, opposite 155 lbs., the pressure, 45·16, which is practically 45⅛, the diameter is found in the column under ½ inch, which is the minimum thickness the steel plate should be,

$$\tfrac{1}{2} \text{ inch} = T.$$

If the working pressure has to be determined when the thickness of the plate is ⅝ inch, and the outside diameter is 50 inches :—

* See note on next page for furnaces of the cambered section.

If the working pressure has to be determined when the thickness of the plate is ⅝ inch, and the outside diameter is 50 inches :—

Then, in the column under ⅝ inch, the thickness, 50, the diameter, is found, and opposite it the pressure is 175 lbs., which is the maximum working pressure,

$$175 = B.$$

The ribbed and grooved furnace to which the previous remarks refer is known as Brown's furnace or Purves's patent. The particular form of rib and groove may not have been adopted until made by Messrs John Brown & Co., who for a good many years have had a good share of the orders for furnaces, particularly those for marine boilers. A few of these furnaces may have come to grief, but it is well known that in many cases it was due to the treatment they received *after* they left Messrs Brown's works, and *not* to the quality of the material or type of furnace. Their behaviour and progress up to the present time must be very encouraging both to patentee and manufacturer.

Cambered Furnaces.

NOTE.—There are *now* few furnaces of the ribbed and grooved section made ; Messrs Brown, the makers of the furnaces, have adopted other sections. That known as the cambered section may be allowed the same pressures as found by the Tables Nos. 178, 179 and 344 for ribbed and grooved furnaces. The diameter for determining the working pressure is the outside diameter in inches at the bottom of thé camber.

FURNACES WITH RIBBED PROJECTIONS, GROOVED INSIDE. Table No. 178.

Steel Plates from $\frac{1}{4}$ inch to $\frac{7}{16}$ inch thick.

Pressures and Diameters.*

Pressure per square inch.	Thicknesses and Diameters.						
	¼ in.	9/32 in.	5/16 in.	11/32 in.	⅜ in.	13/32 in.	7/16 in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs.							
5	...	...	...	...	...	...	...
10	...	...	...	...	...	...	...
15	...	...	...	...	...	...	...
20	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...
30	...	...	...	...	...	...	...
35	...	...	...	...	...	...	...
40	...	...	...	...	...	...	...
45	...	...	...	...	...	...	...
50	...	...	...	...	...	...	...
55	...	...	...	...	...	...	...
60	58·33	...	...	...	...	...	...
65	53·84	...	...	...	...	...	...
70	50·0	56·25	...	...	...	...	...
75	46·66	52·50	58·33	...	...	...	...
80	43·75	49·21	54·68	...	...	...	...
85	41·17	46·32	51·47	56·61	...	...	...
90	38·88	43·75	48·61	53·47	58·33	...	...
95	36·84	41·44	46·05	50·65	55·26	...	...
100	35·0	39·37	43·75	48·12	52·50	56·87	...
105	33·33	37·50	41·66	45·83	50·0	54·16	58·33
110	31·81	35·79	39·77	43·75	47·72	51·70	55·68
115	30·43	34·23	38·04	41·84	45·65	49·45	53·26
120	29·16	32·81	36·45	40·10	43·75	47·39	51·04
125	28·0	31·50	35·0	38·50	42·0	45·50	49·0
130	26·92	30·28	33·65	37·01	40·38	43·75	47·11
135	25·92	29·16	32·40	35·64	38·88	42·12	45·37
140	25·0	28·12	31·25	34·37	37·50	40·62	43·75
145	24·13	27·15	30·17	33·18	36·20	39·22	42·24
150	23·33	26·25	29·16	32·08	35·0	37·91	40·83
155	22·58	25·40	28·22	31·04	33·87	36·69	39·51
160	21·87	24·60	27·34	30·07	32·81	35·54	38·28

* When the height of the ribs above the plain parts is not less than 1 5/16 inch, the depth of the grooves not greater than ¾ inch, the length not greater than 9 inches between the centres of the ribs, and the plain parts at the ends not longer than 6 inches.

Steel Plates from $\frac{15}{32}$ inch to $\frac{5}{8}$ inch thick.
Pressures and Diameters.*

Pressure per square inch.	Thicknesses and Diameters.					
	15/32 in.	1/2 in.	17/32 in.	9/16 in.	19/32 in.	5/8 in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs.						
5	...	...	...	...	...	...
10	...	...	...	...	...	...
15	...	...	...	...	...	...
20	...	...	...	...	...	...
25	...	...	...	...	...	...
30	...	...	..	...	...	...
35	...	...	...	...	...	...
40	...	...	...	...	...	...
45	...	...	...	...	...	...
50	...	...	...	...	...	...
55	...	...	...	...	...	...
60	...	...	...	...	...	...
65	...	...	...	...	...	...
70	...	...	...	...	...	...
75	...	...	...	...	...	...
80	...	...	...	...	...	...
85	...	...	...	...	...	...
90	...	...	...	...	...	...
95	...	...	...	...	...	...
100	...	...	...	...	...	...
105	...	...	...	...	...	...
110	...	...	...	...	...	...
115	57·06	...	...	...	...	...
120	54·68	58·33	...	...	...	...
125	52·50	56·0	...	...	...	...
130	50·48	53·84	57·21	...	...	...
135	48·61	51·85	55·09	58·33	...	...
140	46·87	50·0	53·12	56·25	...	...
145	45·25	48·27	51·29	54·31	57·32	...
150	43·75	46·66	49·58	52·50	55·41	58·33
155	42·33	45·16	47·98	50·80	53·62	56·45
160	41·01	43·75	46·48	49·21	51·95	54·68

* When the height of the ribs above the plain parts is not less than 1 6/16 inch, the depth of the grooves not greater than 3/4 inch, the length not greater than 9 inches between the centres of the ribs, and the plain parts at the ends not longer than 6 inches.

SPIRAL CORRUGATED FURNACES.

Steel Plates.

These furnaces are known as the Farnley corrugated flue, or as Fenby's Patent flue, but it is not known that many are now made.

The mean outside diameter is the outside diameter of outer corrugations *minus* the depth of one corrugation, or the inside diameter of the inner corrugations *plus* twice the thickness of the tube *plus* the depth of one corrugation. When *about* 40 inches diameter, the pitch of the corrugations is *about* 6 feet, and it increases and decreases in *about* the same ratio as the diameter increases and decreases; when the distance between centres of corrugations is 6 inches, and the depth not less than $1\frac{5}{8}$ inch from the top outside to the bottom outside, and when the plain parts at the ends do not exceed 4 inches, if made of the best steel plates not less than $\frac{3}{8}$ inch thick, the working pressure for furnaces of ordinary diameter, and cylindrical throughout their whole lengths and the plates of the best mild steel may be found by the following formulæ:—

T = Thickness of plate, in inches.
D = Mean outside diameter of furnace, in inches.
C = 11100.
B = Working pressure, per square inch in lbs.

$$\frac{C \times T}{D} = B.$$

$$\frac{C \times T}{B} = D.$$

$$\frac{B \times D}{C} = T.$$

AREAS OF CIRCLES.

The following Tables, Nos. 180 to 184, contain areas of circles whose diameters commence at ·01 and increase by one-hundredth part up to 9·99; they are applicable for larger diameters if attention be paid to the position of the decimal point.

For every figure the decimal point is shifted to the right in the diameter, the decimal point should be shifted *two* to the right in the area.

For example, if it be wished to find the area of 99, the area of 9·9 is found from the tables to be 76·9769, and the area of 99 is therefore 7697·69, and as the area of 9·99 from the tables is 78·3828, the area of 999 is 783828; the decimal point in the diameter in the latter case having been shifted two to the right, the decimal point in the area is consequently shifted double that number, or four places, also to the right.

By the foregoing method the tables can be made applicable up to 999 diameter, or 100 times greater than given in the tables.

AREAS OF CIRCLES, ADVANCING BY HUNDREDTHS. TABLE No. 180.

Diam.	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09	Diam.
·0	·0	·000078	·000314	·000706	·001256	·001963	·002827	·003848	·005026	·006361	·0
·1	·007854	·009503	·011310	·013273	·015394	·017671	·020106	·022698	·025447	·028353	·1
·2	·031416	·034636	·038013	·041548	·045239	·049087	·053093	·057256	·061575	·066052	·2
·3	·070686	·075477	·080425	·085530	·090792	·096211	·10179	·10752	·11341	11946	·3
·4	·12566	·13203	·13854	·14522	·15205	·15904	·16619	·17349	·18096	·18857	·4
·5	·19635	·20428	·21237	·22062	·22902	·23758	·24630	·25518	·26421	·27340	·5
·6	·28274	·29225	·30191	·31172	·32170	·33183	·34212	·35257	·36317	·37393	·6
·7	·38485	·39592	·40715	·41854	·43008	·44179	·45365	·46566	·47784	·49017	·7
·8	·50265	·51530	·52810	·54106	·55418	·56745	·58088	·59447	·60821	·62211	·8
·9	·63617	·65039	·66476	·67929	·69398	·70882	·72382	·73898	·75430	·76977	·9
1·0	·78540	·80118	·81713	·83323	·84949	·86590	·88247	·89920	·91609	·93313	1·0
1·1	·95033	·96769	·98520	1·0029	1·0207	1·0387	1·0568	1·0751	1·0936	1·1122	1·1
1·2	1·1310	1·1499	1·1690	1·1882	1·2076	1·2272	1·2469	1·2668	1·2868	1·3070	1·2
1·3	1·3273	1·3478	1·3685	1·3893	1·4103	1·4314	1·4527	1·4741	1·4957	1·5175	1·3
1·4	1·5394	1·5615	1·5837	1·6061	1·6286	1·6513	1·6742	1·6972	1·7203	1·7437	1·4
1·5	1·7671	1·7908	1·8146	1·8385	1·8627	1·8869	1·9113	1·9359	1·9607	1·9856	1·5
1·6	2·0106	2·0358	2·0612	2·0867	2·1124	2·1382	2·1642	2·1904	2·2167	2·2432	1·6
1·7	2·2698	2·2966	2·3235	2·3506	2·3779	2·4053	2·4328	2·4606	2·4885	2·5165	1·7
1·8	2·5447	2·5730	2·6016	2·6302	2·6590	2·6880	2·7172	2·7465	2·7759	2·8055	1·8
1·9	2·8353	2·8652	2·8953	2·9255	2·9559	2·9865	3·0172	3·0481	3·0791	3·1103	1·9
2·0	3·1416	3·1731	3·2047	3·2365	3·2685	3·3006	3·3329	3·3654	3·3979	3·4307	2·0

AREAS OF CIRCLES, ADVANCING BY HUNDREDTHS. TABLE No. 181.

Diam.	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09	Diam.
2·1	3·4636	3·4967	3·5299	3·5633	3·5968	3·6305	3·6644	3·6984	3·7325	3·7668	2·1
2·2	3·8013	3·8360	3·8708	3·9057	3·9408	3·9761	4·0115	4·0471	4·0828	4·1187	2·2
2·3	4·1548	4·1910	4·2273	4·2638	4·3005	4·3374	4·3744	4·4115	4·4488	4·4863	2·3
2·4	4·5239	4·5617	4·5996	4·6877	4·6759	4·7144	4·7529	4·7916	4·8305	4·8695	2·4
2·5	4·9087	4·9481	4·9876	5·0273	5·0671	5·1071	5·1472	5·1875	5·2279	5·2685	2·5
2·6	5·3093	5·3502	5·3913	5·4325	5·4739	5·5155	5·5572	5·5990	5·6410	5·6832	2·6
2·7	5·7256	5·7680	5·8107	5·8535	5·8965	5·9396	5·9828	6·0263	6·0699	6·1136	2·7
2·8	6·1575	6·2016	6·2458	6·2902	6·3347	6·3794	6·4242	6·4692	6·5144	6·5597	2·8
2·9	6·6052	6·6508	6·6966	6·7426	6·7887	6·8349	6·8813	6·9279	6·9747	7·0215	2·9
3·0	7·0686	7·1158	7·1631	7·2107	7·2583	7·3062	7·3542	7·4023	7·4506	7·4991	3·0
3·1	7·5477	7·5964	7·6454	7·6945	7·7437	7·7931	7·8427	7·8924	7·9423	7·9923	3·1
3·2	8·0425	8·0928	8·1433	8·1940	8·2448	8·2958	8·3469	8·3982	8·4496	8·5012	3·2
3·3	8·5530	8·6049	8·6570	8·7092	8·7616	8·8141	8·8668	8·9197	8·9727	9·0259	3·3
3·4	9·0792	9·1327	9·1863	9·2401	9·2941	9·3482	9·4025	9·4569	9·5115	9·5662	3·4
3·5	9·6211	9·6762	9·7314	9·7868	9·8423	9·8980	9·9538	10·0098	10·0660	10·1223	3·5
3·6	10·1788	10·2354	10·2922	10·3491	10·4062	10·4635	10·5209	10·5784	10·6362	10·6941	3·6
3·7	10·7521	10·8103	10·8687	10·9272	10·9858	11·0447	11·1036	11·1628	11·2221	11·2815	3·7
3·8	11·3411	11·4009	11·4608	11·5209	11·5812	11·6416	11·7021	11·7628	11·8237	11·8847	3·8
3·9	11·9459	12·0072	12·0687	12·1304	12·1922	12·2542	12·3163	12·3786	12·4410	12·5036	3·9
4·0	12·5664	12·6293	12·6923	12·7556	12·8190	12·8825	12·9462	13·0100	13·0741	13·1382	4·0
4·1	13·2025	13·2670	13·3317	13·3965	13·4614	13·5265	13·5918	13·6572	13·7228	13·7885	4·1

Table No. 182.

AREAS OF CIRCLES, ADVANCING BY HUNDREDTHS.

Diam.	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09	Diam.
4·2	13·8544	13·9205	13·9867	14·0531	14·1196	14·1863	14·2531	14·3201	14·3872	14·4545	4·2
4·3	14·5220	14·5896	14·6574	14·7254	14·7934	14·8617	14·9301	14·9987	15·0674	15·1363	4·3
4·4	15·2053	15·2745	15·3439	15·4134	15·4830	15·5528	15·6228	15·6930	15·7633	15·8337	4·4
4·5	15·9043	15·9751	16·0460	16·1171	16·1883	16·2597	16·3313	16·4030	16·4748	16·5468	4·5
4·6	16·6190	16·6914	16·7639	16·8365	16·9093	16·9823	17·0554	17·1287	17·2021	17·2757	4·6
4·7	17·3494	17·4234	17·4974	17·5716	17·6460	17·7205	17·7952	17·8701	17·9451	18·0203	4·7
4·8	18·0956	18·1711	18·2467	18·3225	18·3984	18·4745	18·5508	18·6272	18·7038	18·7805	4·8
4·9	18·8574	18·9345	19·0117	19·0890	19·1665	19·2442	19·3221	19·4000	19·4782	19·5565	4·9
5·0	19·6350	19·7136	19·7923	19·8713	19·9504	20·0296	20·1090	20·1886	20·2683	20·3482	5·0
5·1	20·4282	20·5084	20·5887	20·6692	20·7499	20·8307	20·9117	20·9928	21·0741	21·1556	5·1
5·2	21·2372	21·3189	21·4008	21·4829	21·5651	21·6475	21·7301	21·8128	21·8956	21·9787	5·2
5·3	22·0618	22·1452	22·2287	22·3123	22·3961	22·4801	22·5642	22·6484	22·7329	22·8175	5·3
5·4	22·9022	22·9871	23·0722	23·1574	23·2428	23·3283	23·4140	23·4998	23·5858	23·6720	5·4
5·5	23·7583	23·8448	23·9314	24·0182	24·1051	24·1922	24·2795	24·3669	24·4545	24·5422	5·5
5·6	24·6301	24·7181	24·8063	24·8947	24·9832	25·0719	25·1607	25·2497	25·3388	25·4281	5·6
5·7	25·5176	25·6072	25·6970	25·7869	25·8770	25·9672	26·0576	26·1482	26·2389	26·3298	5·7
5·8	26·4208	26·5120	26·6033	26·6948	26·7865	26·8783	26·9703	27·0624	27·1547	27·2471	5·8
5·9	27·3397	27·4325	27·5254	27·6184	27·7117	27·8051	27·8986	27·9923	28·0862	28·1802	5·9
6·0	28·2743	28·3687	28·4631	28·5578	28·6526	28·7475	28·8426	28·9379	29·0333	29·1289	6·0

TABLE No. 183.

AREAS OF CIRCLES, ADVANCING BY HUNDREDTHS.

Diam.	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09	Diam.
6·1	29·2247	29·3206	29·4166	29·5128	29·6092	29·7057	29·8024	29·8992	29·9962	30·0934	6·1
6·2	30·1907	30·2882	30·3858	30·4836	30·5815	30·6796	30·7779	30·8763	30·9748	31·0736	6·2
6·3	31·1725	31·2715	31·3707	31·4700	31·5696	31·6692	31·7690	31·8690	31·9692	32·0695	6·3
6·4	32·1699	32·2705	32·3713	32·4722	32·5733	32·6745	32·7759	32·8775	32·9792	33·0811	6·4
6·5	33·1831	33·2853	33·3876	33·4901	33·5927	33·6955	33·7985	33·9016	34·0049	34·1084	6·5
6·6	34·2119	34·3157	34·4196	34·5237	34·6279	34·7323	34·8368	34·9415	35·0464	35·1514	6·6
6·7	35·2565	35·3618	35·4673	35·5730	35·6788	35·7847	35·8908	35·9971	36·1035	36·2101	6·7
6·8	36·3168	36·4237	36·5308	36·6380	36·7453	36·8528	36·9605	37·0684	37·1764	37·2845	6·8
6·9	37·3928	37·5013	37·6099	37·7187	37·8276	37·9367	38·0459	38·1554	38·2649	38·3746	6·9
7·0	38·4845	38·5945	38·7047	38·8151	38·9256	39·0363	39·1471	39·2581	39·3692	39·4805	7·0
7·1	39·5919	39·7035	39·8153	39·9272	40·0393	40·1515	40·2639	40·3765	40·4892	40·6020	7·1
7·2	40·7150	40·8282	40·9416	41·0550	41·1687	41·2825	41·3965	41·5106	41·6248	41·7393	7·2
7·3	41·8539	41·9686	42·0835	42·1986	42·3138	42·4292	42·5447	42·6604	42·7762	42·8922	7·3
7·4	43·0084	43·1247	43·2412	43·3578	43·4746	43·5916	43·7087	43·8259	43·9433	44·0609	7·4
7·5	44·1786	44·2965	44·4146	44·5328	44·6511	44·7697	44·8883	45·0072	45·1262	45·2453	7·5
7·6	45·3646	45·4841	45·6037	45·7234	45·8434	45·9635	46·0837	46·2041	46·3247	46·4454	7·6
7·7	46·5663	46·6873	46·8085	46·9298	47·0513	47·1730	47·2948	47·4168	47·5389	47·6612	7·7
7·8	47·7836	47·9062	48·0290	48·1519	48·2750	48·3982	48·5216	48·6451	48·7688	48·8927	7·8
7·9	49·0167	49·1409	49·2652	49·3897	49·5143	49·6391	49·7641	49·8892	50·0145	50·1399	7·9

TABLE No. 184.

AREAS OF CIRCLES, ADVANCING BY HUNDREDTHS.

Diam.	·00	·01	·02	·03	·04	·05	·06	·07	·08	·09	Diam.
8·0	50·2655	50·3912	50·5171	50·6432	50·7694	50·8958	51·0223	51·1490	51·2758	51·4028	8·0
8·1	51·5300	51·6573	51·7848	51·9124	52·0402	52·1681	52·2962	52·4245	52·5529	52·6814	8·1
8·2	52·8102	52·9391	53·0681	53·1973	53·3267	53·4562	53·5858	53·7157	53·8456	53·9758	8·2
8·3	54·1061	54·2365	54·3671	54·4979	54·6288	54·7599	54·8912	55·0226	55·1541	55·2858	8·3
8·4	55·4177	55·5497	55·6819	55·8142	55·9467	56·0794	56·2122	56·3452	56·4783	56·6116	8·4
8·5	56·7450	56·8786	57·0124	57·1463	57·2803	57·4146	57·5490	57·6835	57·8182	57·9530	8·5
8·6	58·0881	58·2232	58·3585	58·4940	58·6297	58·7655	58·9014	59·0375	59·1738	59·3102	8·6
8·7	59·4468	59·5835	59·7204	59·8575	59·9947	60·1320	60·2696	60·4073	60·5451	60·6831	8·7
8·8	60·8212	60·9595	61·0980	61·2366	61·3754	61·5144	61·6534	61·7927	61·9321	62·0717	8·8
8·9	62·2114	62·3513	62·4913	62·6315	62·7719	62·9124	63·0530	63·1938	63·3348	63·4760	8·9
9·0	63·6173	63·7587	63·9003	64·0421	64·1840	64·3261	64·4683	64·6107	64·7533	64·8960	9·0
9·1	65·0388	65·1818	65·3250	65·4684	65·6119	65·7555	65·8993	66·0433	66·1874	66·3317	9·1
9·2	66·4761	66·6207	66·7654	66·9104	67·0554	67·2006	67·3460	67·4915	67·6372	67·7831	9·2
9·3	67·9291	68·0753	68·2216	68·3680	68·5147	68·6615	68·8084	68·9555	69·1028	69·2502	9·3
9·4	69·3978	69·5455	69·6934	69·8415	69·9897	70·1380	70·2865	70·4352	70·5841	70·7330	9·4
9·5	70·8822	71·0315	71·1810	71·3306	71·4803	71·6303	71·7804	71·9306	72·0810	72·2316	9·5
9·6	72·3823	72·5332	72·6842	72·8354	72·9867	73·1382	73·2899	73·4417	73·5937	73·7458	9·6
9·7	73·8981	74·0506	74·2032	74·3559	74·5088	74·6619	74·8151	74·9685	75·1221	75·2758	9·7
9·8	75·4296	75·5837	75·7378	75·8922	76·0467	76·2013	76·3561	76·5111	76·6662	76·8214	9·8
9·9	76·9769	77·1325	77·2882	77·4441	77·6002	77·7564	77·9128	78·0693	78·2260	78·3828	9·9

AREAS OF CIRCLES.

The following Tables, Nos. 185 to 191, contain areas of circles for diameters, increasing by fractional parts of one thirty-second to 21, by one sixteenth from 21 to 49, and by one eighth from 49 to 104⅞ diameter.

AREAS OF CIRCLES.

Advancing by Thirty-Seconds.

Diam.	0	1	2	3	4	5	6	Diam.
		·78540	3·1416	7·0686	12·566	19·635	28·274	
1/32	·000767	·83525	3·2405	7·2166	12·763	19·881	28·570	1/32
1/16	·003068	·88664	3·3410	7·3662	12·962	20·129	28·866	1/16
3/32	·006903	·93956	3·4430	7·5173	13·162	20·378	29·165	3/32
1/8	·012272	·99402	3·5466	7·6699	13·364	20·629	29·465	1/8
5/32	·019175	1·0500	3·6516	7·8241	13·567	20·881	29·766	5/32
3/16	·027612	1·1075	3·7583	7.9798	13·772	21·135	30·069	3/16
7/32	·037583	1·1666	3·8664	8·1370	13·978	21·391	30·374	7/32
1/4	·049087	1·2272	3·9761	8·2958	14·186	21·648	30·680	1/4
9/32	·062126	1·2893	4·0873	8·4561	14·396	21·906	30·987	9/32
5/16	·076699	1·3530	4·2000	8·6179	14·607	22·166	31·296	5/16
11/32	·092806	1·4182	4·3143	8·7813	14·819	22·428	31·607	11/32
3/8	·11045	1·4849	4·4301	8·9462	15·033	22·691	31·919	3/8
13/32	·12962	1·5532	4·5475	9·1126	15·249	22·955	32·233	13/32
7/16	·15033	1·6230	4·6664	9·2806	15·466	23·221	32·548	7/16
15/32	·17257	1·6943	4·7868	9·4501	15·684	23·489	32·865	15/32
1/2	·19635	1·7671	4·9087	9·6211	15·904	23·758	33·183	1/2
17/32	·22166	1·8415	5·0322	9·7937	16·126	24·029	33·503	17/32
9/16	·24850	1·9175	5·1572	9·9678	16·349	24·301	33·824	9/16
19/32	·27688	1·9949	5·2838	10·143	16·574	24·575	34·147	19/32
5/8	·30680	2·0739	5·4119	10·321	16·800	24·850	34·472	5/8
21/32	·33824	2·1545	5·5415	10·499	17·028	25·127	34·798	21/32
11/16	·37122	2·2365	5·6727	10·680	17·257	25·406	35·125	11/16
23/32	·40574	2·3201	5·8054	10·861	17·488	25·686	35·454	23/32
3/4	·44179	2·4053	5·9396	11·045	17·721	25·967	35·785	3/4
25/32	·47937	2·4920	6·0753	11·230	17·954	26·250	36·117	25/32
13/16	·51849	2·5802	6·2126	11·416	18·190	26·535	36·450	13/16
27/32	·55914	2·6699	6·3514	11·604	18·427	26·821	36·786	27/32
7/8	·60132	2·7612	6·4918	11·793	18·665	27·109	37·122	7/8
29/32	·64504	2·8540	6·6337	11·984	18·906	27·398	37·461	29/32
15/16	·69029	2·9483	6·7771	12·177	19·147	27·688	37·800	15/16
31/32	·73708	3·0442	6·9221	12·371	19·390	27·981	38·142	31/32

AREAS OF CIRCLES.

Advancing by Thirty-Seconds.

Diam.	7	8	9	10	11	12	13	Diam.
	38·485	50·265	63·617	78·540	95·033	113·10	132·73	
1/32	38·829	50·659	64·060	79·031	95·574	113·69	133·37	1/32
1/16	39·175	51·054	64·504	79·525	96·116	114·28	134·01	1/16
3/32	39·522	51·450	64·950	80·019	96·660	114·87	134·65	3/32
1/8	39·871	51·849	65·397	80·516	97·205	115·47	135·30	1/8
5/32	40·222	52·248	65·845	81·013	97·752	116·06	135·94	5/32
3/16	40·574	52·649	66·296	81·513	98·301	116·66	136·59	3/16
7/32	40·927	53·052	66·747	82·014	98·850	117·26	137·24	7/32
1/4	41·282	53·456	67·201	82·516	99·402	117·86	137·89	1/4
9/32	41·639	53·862	67·655	83·020	99·955	118·46	138·54	9/32
5/16	41·997	54·269	68·112	83·525	100·51	119·06	139·19	5/16
11/32	42·357	54·678	68·570	84·032	101·07	119·67	139·84	11/32
3/8	42·718	55·088	69·029	84·541	101·62	120·28	140·50	3/8
13/32	43·081	55·500	69·490	85·051	102·18	120·88	141·16	13/32
7/16	43·445	55·914	69·953	85·562	102·74	121·49	141·82	7/16
15/32	43·811	56·329	70·417	86·076	103·31	122·11	142·48	15/32
1/2	44·179	56·745	70·882	86·590	103·87	122·72	143·14	1/2
17/32	44·548	57·163	71·349	87·106	104·43	123·33	143·80	17/32
9/16	44·918	57·583	71·818	87·624	105·00	123·95	144·47	9/16
19/32	45·290	58·004	72·288	88·143	105·57	124·57	145·13	19/32
5/8	45·664	58·426	72·760	88·664	106·14	125·19	145·80	5/8
21/32	46·039	58·850	73·233	89·186	106·71	125·81	146·47	21/32
11/16	46·415	59·276	73·708	89·710	107·28	126·43	147·14	11/16
23/32	46·793	59·703	74·184	90·236	107·86	127·05	147·82	23/32
3/4	47·173	60·132	74·662	90·763	108·43	127·68	148·49	3/4
25/32	47·554	60·562	75·141	91·291	109·01	128·30	149·17	25/32
13/16	47·937	60·994	75·622	91·821	109·59	128·93	149·84	13/16
27/32	48·321	61·427	76·105	92·353	110·17	129·56	150·52	27/32
7/8	48·707	61·862	76·589	92·886	110·75	130·19	151·20	7/8
29/32	49·094	62·299	77·074	93·420	111·34	130·82	151·88	29/32
15/16	49·483	62·737	77·561	93·956	111·92	131·46	152·57	15/16
31/32	49·874	63·176	78·050	94·494	112·51	132·09	153·25	31/32

AREAS OF CIRCLES.

Advancing by Thirty-Seconds.

Diam.	14	15	16	17	18	19	20	Diam.
	153·94	176·71	201·06	226·98	254·47	283·53	314·16	
1/32	154·63	177·45	201·85	227·82	255·35	284·46	315·14	1/32
1/16	155·32	178·19	202·64	228·65	256·24	285·40	316·13	1/16
3/32	156·01	178·93	203·43	229·49	257·13	286·33	317·11	3/32
1/8	156·70	179·67	204·22	230·33	258·02	287·27	318·10	1/8
5/32	157·39	180·42	205·01	231·17	258·91	288·21	319·09	5/32
3/16	158·09	181·16	205·80	232·01	259·80	289·15	320·08	3/16
7/32	158·79	181·91	206·60	232·86	260·69	290·09	321·07	7/32
1/4	159·48	182·65	207·39	233·71	261·59	291·04	322·06	1/4
9/32	160·19	183·40	208·19	234·55	262·48	291·98	323·06	9/32
5/16	160·89	184·15	208·99	235·40	263·38	292·93	324·05	5/16
11/32	161·59	184·91	209·79	236·25	264·28	293·88	325·05	11/32
3/8	162·30	185·66	210·60	237·10	265·18	294·83	326·05	3/8
13/32	163·00	186·42	211·40	237·96	266·09	295·78	327·05	13/32
7/16	163·71	187·17	212·21	238·81	266·99	296·74	328·05	7/16
15/32	164·42	187·93	213·02	239·67	267·90	297·69	329·06	15/32
1/2	165·13	188·69	213·82	240·53	268·80	298·65	330·06	1/2
17/32	165·84	189·45	214·64	241·39	269·71	299·61	331·07	17/32
9/16	166·56	190·22	215·45	242·25	270·62	300·57	332·08	9/16
19/32	167·27	190·98	216·26	243·11	271·53	301·53	333·09	19/32
5/8	167·99	191·75	217·08	243·98	272·45	302·49	334·10	5/8
21/32	168·71	192·52	217·89	244·84	273·36	303·45	335·11	21/32
11/16	169·43	193·28	218·71	245·71	274·28	304·42	336·13	11/16
23/32	170·15	194·06	219·53	246·58	275·20	305·39	337·15	23/32
3/4	170·87	194·83	220·35	247·45	276·12	306·35	338·16	3/4
25/32	171·60	195·60	221·18	248·32	277·04	307·32	339·18	25/32
13/16	172·32	196·38	222·00	249·20	277·96	308·30	340·20	13/16
27/32	173·05	197·15	222·83	250·07	278·88	309·27	341·23	27/32
7/8	173·78	197·93	223·65	250·95	279·81	310·24	342·25	7/8
29/32	174·51	198·71	224·48	251·83	280·74	311·22	343·28	29/32
15/16	175·25	199·49	225·31	252·70	281·67	312·20	344·30	15/16
31/32	175·98	200·28	226·15	253·59	282·60	313·18	345·33	31/32

AREAS OF CIRCLES.

Advancing by Sixteenths.

Diam.	21	22	23	24	25	26	27	Diam.
	346·36	380·13	415·48	452·39	490·87	530·93	572·56	
1/16	348·43	382·30	417·74	454·75	493·33	533·48	575·21	1/16
1/8	350·50	384·46	420·00	457·11	495·79	536·05	577·87	1/8
3/16	352·57	386·64	422·28	459·49	498·26	538·61	580·54	3/16
1/4	354·66	388·82	424·56	461·86	500·74	541·19	583·21	1/4
5/16	356·75	391·01	426·84	464·25	503·22	543·77	585·89	5/16
3/8	358·84	393·20	429·13	466·64	505·71	546·35	588·57	3/8
7/16	360·94	395·40	431·43	469·03	508·20	548·95	591·26	7/16
1/2	363·05	397·61	433·74	471·44	510·71	551·55	593·96	1/2
9/16	365·16	399·82	436·05	473·84	513·21	554·15	596·66	9/16
5/8	367·28	402·04	438·36	476·26	515·72	556·76	599·37	5/8
11/16	369·41	404·26	440·69	478·68	518·24	559·38	602·08	11/16
3/4	371·54	406·49	443·01	481·11	520·77	562·00	604·81	3/4
13/16	373·68	408·73	445·35	483·54	523·30	564·63	607·53	13/16
7/8	375·83	410·97	447·69	485·98	525·84	567·27	610·27	7/8
15/16	377·98	413·22	450·04	488·42	528·38	569·91	613·01	15/16

Diam.	28	29	30	31	32	33	34	Diam.
	615·75	660·52	706·86	754·77	804·25	855·30	907·92	
1/16	618·50	663·37	709·81	757·81	807·39	858·54	911·26	1/16
1/8	621·26	666·23	712·76	760·87	810·54	861·79	914·61	1/8
3/16	624·03	669·09	715·72	763·93	813·70	865·05	917·96	3/16
1/4	626·80	671·96	718·69	766·99	816·86	868·31	921·32	1/4
5/16	629·57	674·83	721·66	770·06	820·03	871·57	924·69	5/16
3/8	632·36	677·71	724·64	773·14	823·21	874·85	928·06	3/8
7/16	635·14	680·60	727·63	776·22	826·39	878·13	931·44	7/16
1/2	637·94	683·49	730·62	779·31	829·58	881·41	934·82	1/2
9/16	640·74	686·39	733·61	782·41	832·77	884·71	938·21	9/16
5/8	643·55	689·30	736·62	785·51	835·97	888·00	941·61	5/8
11/16	646·36	692·21	739·63	788·62	839·18	891·31	945·01	11/16
3/4	649·18	695·13	742·64	791·73	842·39	894·62	948·42	3/4
13/16	652·01	698·05	745·67	794·85	845·61	897·93	951·83	13/16
7/8	654·84	700·98	748·69	797·98	848·83	901·26	955·25	7/8
15/16	657·68	703·92	751·73	801·11	852·06	904·59	958·68	15/16

AREAS OF CIRCLES.

Advancing by Sixteenths.

Diam.	35	36	37	38	39	40	41	Diam.
	962·11	1017·9	1075·2	1134·1	1194·6	1256·6	1320·3	
1/16	965·55	1021·4	1078·8	1137·8	1198·4	1260·6	1324·3	1/16
1/8	969·00	1025·0	1082·5	1141·6	1202·3	1264·5	1328·3	1/8
3/16	972·45	1028·5	1086·1	1145·3	1206·1	1268·4	1332·4	3/16
1/4	975·91	1032·1	1089·8	1149·1	1210·0	1272·4	1336·4	1/4
5/16	979·37	1035·6	1093·4	1152·8	1213·8	1276·3	1340·5	5/16
3/8	982·84	1039·2	1097·1	1156·6	1217·7	1280·3	1344·5	3/8
7/16	986·32	1042·8	1100·8	1160·4	1221·5	1284·3	1348·6	7/16
1/2	989·80	1046·3	1104·5	1164·2	1225·4	1288·2	1352·7	1/2
9/16	993·29	1049·9	1108·2	1167·9	1229·3	1292·2	1356·7	9/16
5/8	996·78	1053·5	1111·8	1171·7	1233·2	1296·2	1360·8	5/8
11/16	1000·3	1057·1	1115·5	1175·5	1237·1	1300·2	1364·9	11/16
3/4	1003·8	1060·7	1119·2	1179·3	1241·0	1304·2	1369·0	3/4
13/16	1007·3	1064·3	1123·0	1183·1	1244·9	1308·2	1373·1	13/16
7/8	1010·8	1068·0	1126·7	1186·9	1248·8	1312·2	1377·2	7/8
15/16	1014·3	1071·6	1130·4	1190·8	1252·7	1316·2	1381·3	15/16

Diam.	42	43	44	45	46	47	48	Diam.
	1385·4	1452·2	1520·5	1590·4	1661·9	1734·9	1809·6	
1/16	1389·6	1456·4	1524·9	1594·9	1666·4	1739·6	1814·3	1/16
1/8	1393·7	1460·7	1529·2	1599·3	1670·9	1744·2	1819·0	1/8
3/16	1397·8	1464·9	1533·5	1603·7	1675·5	1748·8	1823·7	3/16
1/4	1402·0	1469·1	1537·9	1608·2	1680·0	1753·5	1828·5	1/4
5/16	1406·1	1473·4	1542·2	1612·6	1684·6	1758·1	1833·2	5/16
3/8	1410·3	1477·6	1546·6	1617·0	1689·1	1762·7	1837·9	3/8
7/16	1414·5	1481·9	1550·9	1621·5	1693·7	1767·4	1842·7	7/16
1/2	1418·6	1486·2	1555·3	1626·0	1698·2	1772·1	1847·5	1/2
9/16	1422·8	1490·4	1559·7	1630·4	1702·8	1776·7	1852·2	9/16
5/8	1427·0	1494·7	1564·0	1634·9	1707·4	1781·4	1857·0	5/8
11/16	1431·2	1499·0	1568·4	1639·4	1712·0	1786·1	1861·8	11/16
3/4	1435·4	1503·3	1572·8	1643·9	1716·5	1790·8	1866·5	3/4
13/16	1439·6	1507·6	1577·2	1648·4	1721·1	1795·4	1871·3	13/16
7/8	1443·8	1511·9	1581·6	1652·9	1725·7	1800·1	1876·1	7/8
15/16	1448·0	1516·2	1586·0	1657·4	1730·3	1804·8	1880·9	15/16

Advancing by Eighths.

Diam.	49	50	51	52	53	54	55	Diam.
	1885·7	1963·5	2042·8	2123·7	2206·2	2290·2	2375·8	
⅛	1895·4	1973·3	2052·8	2133·9	2216·6	2300·8	2386·6	⅛
¼	1905·0	1983·2	2062·9	2144·2	2227·0	2311·5	2397·5	¼
⅜	1914·7	1993·1	2073·0	2154·5	2237·5	2322·1	2408·3	⅜
½	1924·4	2003·0	2083·1	2164·8	2248·0	2332·8	2419·2	½
⅝	1934·2	2012·9	2093·2	2175·1	2258·5	2343·5	2430·1	⅝
¾	1943·9	2022·8	2103·3	2185·4	2269·1	2354·3	2441·1	¾
⅞	1953·7	2032·8	2113·5	2195·8	2279·6	2365·0	2452·0	⅞
Diam.	56	57	58	59	60	61	62	Diam.
	2463·0	2551·8	2642·1	2734·0	2827·4	2922·5	3019·1	
⅛	2474·0	2563·0	2653·5	2745·6	2839·2	2934·5	3031·3	⅛
¼	2485·0	2574·2	2664·9	2757·2	2851·0	2946·5	3043·5	¼
⅜	2496·1	2585·4	2676·4	2768·8	2862·9	2958·5	3055·7	⅜
½	2507·2	2596·7	2687·8	2780·5	2874·8	2970·6	3068·0	½
⅝	2518·3	2608·0	2699·3	2792·2	2886·6	2982·7	3080·2	⅝
¾	2529·4	2619·4	2710·9	2803·9	2898·6	2994·8	3092·6	¾
⅞	2540·6	2630·7	2722·4	2815·7	2910·5	3006·9	3104·9	⅞
Diam.	63	64	65	66	67	68	69	Diam.
	3117·2	3217·0	3318·3	3421·2	3525·7	3631·7	3739·3	
⅛	3129·6	3229·6	3331·1	3434·2	3538·8	3645·0	3752·8	⅛
¼	3142·0	3242·2	3343·9	3447·2	3552·0	3658·4	3766·4	¼
⅜	3154·5	3254·8	3356·7	3460·2	3565·2	3671·8	3780·0	⅜
½	3166·9	3267·5	3369·6	3473·2	3578·5	3685·3	3793·7	½
⅝	3179·4	3280·1	3382·4	3486·3	3591·7	3698·7	3807·3	⅝
¾	3191·9	3292·8	3395·3	3499·4	3605·0	3712·2	3821·0	¾
⅞	3204·4	3305·6	3408·2	3512·5	3618·3	3725·7	3834·7	⅞
Diam.	70	71	72	73	74	75	76	Diam.
	3848·5	3959·2	4071·5	4185·4	4300·8	4417·9	4536·5	
⅛	3862·2	3973·1	4085·7	4199·7	4315·4	4432·6	4551·4	⅛
¼	3876·0	3987·1	4099·8	4214·1	4329·9	4447·4	4566·4	¼
⅜	3889·8	4001·1	4114·0	4228·5	4344·5	4462·2	4581·3	⅜
½	3903·6	4015·2	4128·2	4242·9	4359·2	4477·0	4596·3	½
⅝	3917·5	4029·2	4142·5	4257·4	4373·8	4491·8	4611·4	⅝
¾	3931·4	4043·3	4156·8	4271·8	4388·5	4506·7	4626·4	¾
⅞	3945·3	4057·4	4171·1	4286·3	4403·2	4521·5	4641·5	⅞

AREAS OF CIRCLES.
Advancing by Eighths.

Diam.	77	78	79	80	81	82	83	Diam.
	4656·6	4778·4	4901·7	5026·5	5153·0	5281·0	5410·6	
⅛	4671·8	4793·7	4917·2	5042·3	5168·9	5297·1	5426·9	⅛
¼	4686·9	4809·0	4932·7	5058·0	5184·9	5313·3	5443·3	¼
⅜	4702·1	4824·4	4948·3	5073·8	5200·8	5329·4	5459·6	⅜
½	4717·3	4839·8	4963·9	5089·6	5216·8	5345·6	5476·0	½
⅝	4732·5	4855·2	4979·5	5105·4	5232·8	5361·8	5492·4	⅝
¾	4747·8	4870·7	4995·2	5121·2	5248·9	5378·1	5508·8	¾
⅞	4763·1	4886·2	5010·9	5137·1	5264·9	5394·3	5525·3	⅞
Diam.	84	85	86	87	88	89	90	Diam.
	5541·8	5674·5	5808·8	5944·7	6082·1	6221·1	6361·7	
⅛	5558·3	5691·2	5825·7	5961·8	6099·4	6238·6	6379·4	⅛
¼	5574·8	5707·9	5842·6	5978·9	6116·7	6256·1	6397·1	¼
⅜	5591·4	5724·7	5859·6	5996·0	6134·1	6273·7	6414·9	⅜
½	5607·9	5741·5	5876·5	6013·2	6151·4	6291·2	6432·6	½
⅝	5624·5	5758·3	5893·5	6030·4	6168·8	6308·8	6450·4	⅝
¾	5641·2	5775·1	5910·6	6047·6	6186·2	6326·4	6468·2	¾
⅞	5657·8	5791·9	5927·6	6064·9	6203·7	6344·1	6486·0	⅞
Diam.	91	92	93	94	95	96	97	Diam.
	6503·9	6647·6	6792·9	6939·8	7088·2	7238·2	7389·8	
⅛	6521·8	6665·7	6811·2	6958·2	7106·9	7257·1	7408·9	⅛
¼	6539·7	6683·8	6829·5	6976·7	7125·6	7276·0	7428·0	¼
⅜	6557·6	6701·9	6847·8	6995·3	7144·3	7294·9	7447·1	⅜
½	6575·6	6720·1	6866·1	7013·8	7163·0	7313·8	7466·2	½
⅝	6593·5	6738·2	6884·5	7032·4	7181·8	7332·8	7485·3	⅝
¾	6611·5	6756·4	6902·9	7051·0	7200·6	7351·8	7504·5	¾
⅞	6629·6	6774·7	6921·3	7069·6	7219·4	7370·8	7523·7	⅞
Diam.	98	99	100	101	102	103	104	Diam.
	7543·0	7697·7	7854·0	8011·8	8171·3	8332·3	8494·9	
⅛	7562·2	7717·1	7873·6	8031·7	8191·3	8352·5	8515·3	⅛
¼	7581·5	7736·6	7893·3	8051·6	8211·4	8372·8	8535·8	¼
⅜	7600·8	7756·1	7913·0	8071·5	8231·5	8393·1	8556·2	⅜
½	7620·1	7775·6	7932·7	8091·4	8251·6	8413·4	8576·7	½
⅝	7639·5	7795·2	7952·5	8111·3	8271·7	8433·7	8597·3	⅝
¾	7658·9	7814·8	7972·2	8131·3	8291·9	8454·1	8617·8	¾
⅞	7678·3	7834·4	7992·0	8151·3	8312·1	8474·5	8638·4	⅞

CIRCUMFERENCES OF CIRCLES.

Advancing by Thirty-seconds.

Fractions.	0	1	2	3	4	5	6	7
	...	3·1416	6·2832	9·4248	12·566	15·708	18·850	21·991
1/32	·09817	3·2398	6·3814	9·5230	12·665	15·806	18·948	22·089
1/16	·19635	3·3379	6·4795	9·6211	12·763	15·904	19·046	22·187
3/32	·29452	3·4361	6·5777	9·7193	12·861	16·002	19·144	22·286
1/8	·39270	3·5343	6·6759	9·8175	12·959	16·101	19·242	22·384
5/32	·49087	3·6325	6·7741	9·9157	13·057	16·199	19·340	22·482
3/16	·58905	3·7306	6·8722	10·014	13·155	16·297	19·439	22·580
7/32	·68722	3·8288	6·9704	10·112	13·254	16·395	19·537	22·678
1/4	·78540	3·9270	7·0686	10·210	13·352	16·493	19·635	22·777
9/32	·88357	4·0252	7·1668	10·308	13·450	16·592	19·733	22·875
5/16	·98175	4·1233	7·2649	10·407	13·548	16·690	19·831	22·973
11/32	1·0799	4·2215	7·3631	10·505	13·646	16·788	19·929	23·071
3/8	1·1781	4·3197	7·4613	10·603	13·744	16·886	20·028	23·169
13/32	1·2763	4·4179	7·5595	10·701	13·843	16·984	20·126	23·267
7/16	1·3744	4·5160	7·6576	10·799	13·941	17·082	20·224	23·366
15/32	1·4726	4·6142	7·7558	10·897	14·039	17·181	20·322	23·464
1/2	1·5708	4·7124	7·8540	10·996	14·137	17·279	20·420	23·562
17/32	1·6690	4·8106	7·9522	11·094	14·235	17·377	20·519	23·660
9/16	1·7671	4·9087	8·0503	11·192	14·334	17·475	20·617	23·758
19/32	1·8653	5·0069	8·1485	11·290	14·432	17·573	20·715	23·856
5/8	1·9635	5·1051	8·2467	11·388	14·530	17·671	20·813	23·955
21/32	2·0617	5·2033	8·3449	11·486	14·628	17·770	20·911	24·053
11/16	2·1598	5·3014	8·4430	11·585	14·726	17·868	21·009	24·151
23/32	2·2580	5·3996	8·5412	11·683	14·824	17·966	21·108	24·249
3/4	2·3562	5·4978	8·6394	11·781	14·923	18·064	21·206	24·347
25/32	2·4544	5·5960	8·7376	11·879	15·021	18·162	21·304	24·446
13/16	2·5525	5·6941	8·8357	11·977	15·119	18·261	21·402	24·544
27/32	2·6507	5·7923	8·9339	12·075	15·217	18·359	21·500	24·642
7/8	2·7489	5·8905	9·0321	12·174	15·315	18·457	21·598	24·740
29/32	2·8471	5·9887	9·1303	12·272	15·413	18·555	21·697	24·838
15/16	2·9452	6·0868	9·2284	12·370	15·512	18·653	21·795	24·936
31/32	3·0434	6·1850	9·3266	12·468	15·610	18·751	21·893	25·035

When the circumference is required to be found to greater accuracy than given in above Table, multiply the diameter by 3·14159265359, but the circumferences as given in the Table are sufficiently accurate for general engineering purposes.

NUMBERS, VULGAR FRACTIONS, DECIMAL EQUIVALENTS, SQUARES, AND CUBES.

The following Tables, Nos. 193 to 199, contain decimal equivalents of fractions commencing at one sixty-fourth, and increasing by one sixty-fourth up to 2, and by one thirty-second from 2 to 6.

The squares and cubes of fractions and numbers are complete up to $3\frac{5}{16}$. Above $3\frac{5}{16}$, in Tables Nos. 197 to 199, the squares and cubes are given up to $29\frac{3}{4}$, but they are only given to three decimal places, which for practical purposes will *generally* be found to be sufficiently accurate. The numbers increase by one thirty-second up to 6, by sixteenths from 6 to 12, by eighths from 12 to 24, and by one quarter from 24 to $29\frac{3}{4}$.

The following notes may serve to facilitate the obtaining of the squares and cubes of numbers not included in the tables :—

The square of any given number, multiplied by 4, equals the square of twice the given number.

The square of any given number, multiplied by 9, equals the square of three times the given number.

Or, for all cases, it follows that—

If N represents any given number and S the square of N, the square of any multiple of N may be found by multiplying S by the square of the multiple of N determined on ; for example—

If N equals a given number and S the square of N, and the square of 8 times N is required, then $S \times 64$ equals the square of 8N or $(8N)^2$.

The cube of any given number, multiplied by 8, equals the cube of twice the given number.

The cube of any given number, multiplied by 27, equals the cube of three times the given number.

Or, if N represents any given number and C the cube of whatever N may be, then, if the cube of any multiple of N be required, it can be found by multiplying C by the cube of the multiple of N determined on ; for example—

If N equals a given number, C the cube of N, and the cube of 10 times N is required, then $C \times 1000$ equals the cube of 10N or $(10N)^3$.

The tables may also be conveniently used for obtaining the square and cube roots of such numbers as are represented by the squares and cubes, the roots being complete up to 3·3125 ; above that they will be found near enough for ordinary purposes, as the squares and cubes are only a few decimal places short, which is generally of no great practical value.

The tables have a higher range than is necessary for the calculations connected with boilers and safety valves, so as to make them useful for other purposes.

There are several other tables which will reduce labour, and be found of varied use, such as the fourth power of numbers, Table No. 202 ; inches, and their decimal equivalents of a foot, Table No. 200 ; also decimal fractions from ·01 to ·99, and their equivalent values in vulgar fractions, with the sixty-fourths to which they are nearest, or than which they are greater or less.

VULGAR FRACTIONS, DECIMAL EQUIVALENTS, SQUARES AND CUBES. TABLE No. 193.

Fractions.					Equivalents.	Squares.	Cubes.
				1/64	·015625	·000244140625	·000003814697265625
			1/32	2/64	·03125	·0009765625	·000030517578125
				3/64	·046875	·002197265625	·000102996826171875
		1/16	2/32	4/64	·0625	·00390625	·000244140625
				5/64	·078125	·006103515625	·000476837158203125
			3/32	6/64	·09375	·0087890625	·000823974609375
				7/64	109375	·011962890625	·001308441162109375
	1/8	2/16	4/32	8/64	·125	·015625	·001953125
				9/64	·140625	·019775390625	·002780914306640625
			5/32	10/64	·15625	·0244140625	·003814697265625
				11/64	·171875	·029541015625	·005077362060546875
		3/16	6/32	12/64	·1875	·03515625	·006591796875
				13/64	·203125	·041259765625	·008380889892578125
			7/32	14/64	·21875	·0478515625	·010467529296875
				15/64	·234375	·054931640625	·012874603271484375
1/4	2/8	4/16	8/32	16/64	·25	·0625	·015625
				17/64	·265625	·070556640625	·018741607666015625
			9/32	18/64	·28125	·0791015625	·022247314453125
				19/64	·296875	·088134765625	·026165008544921875
		5/16	10/32	20/64	·3125	·09765625	·030517578125
				21/64	·328125	·107666015625	·035327911376953125
			11/32	22/64	·34375	·1181640625	·040618896484375
				23/64	·359375	·129150390625	·046413421630859375
	3/8	6/16	12/32	24/64	·375	·140625	·052734375

VULGAR FRACTIONS, DECIMAL EQUIVALENTS, SQUARES AND CUBES.

Fractions.						Equivalents.	Squares.	Cubes.
					25/64	·390625	·152587890625	·059604644775390625
				13/32	26/64	·40625	·1650390625	·067047119140625
					27/64	·421875	·177978515625	·075084686279296875
			7/16	14/32	28/64	·4375	·19140625	·083740234375
					29/64	·453125	·205322265625	·093036651611328125
				15/32	30/64	·46875	·2197265625	·102996826171875
					31/64	·484375	·234619140625	·113643646240234375
½	2/4	4/8	8/16	16/32	32/64	·5	·25	·125
					33/64	·515625	·265869140625	·137088775634765625
				17/32	34/64	·53125	·2822265625	·149932861328125
					35/64	·546875	·299072265625	·163555145263671875
			9/16	18/32	36/64	·5625	·31640625	·177978515625
					37/64	·578125	·334228515625	·193225860595703125
				19/32	38/64	·59375	·3525590625	·209320068359375
					39/64	·609375	·371337890625	·226284027099609375
		5/8	10/16	20/32	40/64	·625	·390625	·244140625
					41/64	·640625	·410400390625	·262912730244140625
				21/32	42/64	·65625	·4306640625	·282623291015625
					43/64	·671875	·451416015625	·303295135498046875
			11/16	22/32	44/64	·6875	·47265625	·324951171875
					45/64	·703125	·494384765625	·347614288330078125
				23/32	46/64	·71875	·5166015625	·37130737304687 5
					47/64	·734375	·539306640625	·396053314208984375
	3/4	6/8	12/16	24/32	48/64	·75	·5625	·421875

TABLE NO. 195.

NUMBERS, VULGAR FRACTIONS, DECIMAL EQUIVALENTS, SQUARES AND CUBES.

Fractions.					Equivalents.	Squares.	Cubes.
				49/64	·765625	·586181640625	·448795318603515625
			25/32	50/64	·78125	·6103515625	·476837158203125
				51/64	·796875	·635009765625	·506023406982421875
		13/16	26/32	52/64	·8125	·66015625	·536376953125
				53/64	·828125	·685791015625	·567920684814453125
			27/32	54/64	·84375	·7119140625	·600677490234375
				55/64	·859375	·738525390625	·634670257568359375
	7/8	14/16	28/32	56/64	·875	·765625	·669921875
				57/64	·890625	·793212890625	·706455230712890625
			29/32	58/64	·90625	·8212890625	·744293212890625
				59/64	·921875	·849853515625	·783458709716796875
		15/16	30/32	60/64	·9375	·87890625	·823974609375
				61/64	·953125	·908447265625	·865863800048828125
			31/32	62/64	·96875	·9384765625	·909149169921875
				63/64	·984375	·968994140625	·953853607177734375
1					1·0	1·0	1·0
1				1/64	1·015625	1·031494140625	1·047611236572265625
1			1/32	2/64	1·03125	1·0634765625	1·096710205078125
1				3/64	1·046875	1·095947265625	1·147319793701171875
1		1/16	2/32	4/64	1·0625	1·12890625	1·199462890625
1				5/64	1·078125	1·162353515625	1·253162384033203125
1			3/32	6/64	1·09375	1·1962890625	1·308441162109375
1				7/64	1·109375	1·230712890625	1·365322113037109375
1	1/8	2/16	4/32	8/64	1·125	1·265625	1·423828125

TABLE No. 195a.

NUMBERS, VULGAR FRACTIONS, DECIMAL EQUIVALENTS, SQUARES AND CUBES.

Fractions.							Equivalents.	Squares.	Cubes.
1						9/64	1·140625	1·301025390625	1·483982086181640625
1					5/32	10/64	1·15625	1·3369140625	1·545806884765625
1						11/64	1·171875	1·373291015625	1·609325408935546875
1				3/16	6/32	12/64	1·1875	1·41015625	1·674560546875
1						13/64	1·203125	1·447509765625	1·741535186767578125
1					7/32	14/64	1·21875	1·4853515625	1·810272216796875
1						15/64	1·234375	1·523681640625	1·880794525146484375
1		1/4	2/8	4/16	8/32	16/64	1·25	1·5625	1·953125
1						17/64	1·265625	1·601806640625	2·027286529541015625
1					9/32	18/64	1·28125	1·6416015625	2·103302001953125
1						19/64	1·296875	1·681884765625	2·181194305419921875
1				5/16	10/32	20/64	1·3125	1·72265625	2·260986328125
1						21/64	1·328125	1·763916015625	2·342700958251953125
1					11/32	22/64	1·34375	1·8056640625	2·426361083984375
1						23/64	1·359375	1·847900390625	2·511989593505859375
1			3/8	6/16	12/32	24/64	1·375	1·890625	2·599609375
1						25/64	1·390625	1·933837890625	2·689243316650390625
1					13/32	26/64	1·40625	1·9775390625	2·780914306640625
1						27/64	1·421875	2·021728515625	2·874645233154296875
1				7/16	14/32	28/64	1·4375	2·06640625	2·970458984375
1						29/64	1·453125	2·111572265625	3·068378448486328125
1					15/32	30/64	1·46875	2·1572265625	3·168426513671875
1						31/64	1·484375	2·203369140625	3·270626068115234375
1	1/2	2/4	4/8	8/16	16/32	32/64	1·5	2·25	3·375

TABLE No. 196.

NUMBERS, VULGAR FRACTIONS, DECIMAL EQUIVALENTS, SQUARES AND CUBES.

Fractions.						Equivalents.	Squares.	Cubes.
1					33/64	1·515625	2·297119140625	3·481571197509765625
1				17/32	34/64	1·53125	2·3447265625	3·590362548828125
1					35/64	1·546875	2·392822265625	3·701396942138671875
1			9/16	18/32	36/64	1·5625	2·44140625	3·814697265625
1					37/64	1·578125	2·490478515625	3·930286407470703125
1				19/32	38/64	1·59375	2·5400390625	4·048187255859375
1					39/64	1·609375	2·590087890625	4·168422698974609375
1		5/8	10/16	20/32	40/64	1·625	2·640625	4·291015625
1					41/64	1·640625	2·691650390625	4·415988922119140625
1				21/32	42/64	1·65625	2·7431640625	4·543365478515625
1					43/64	1·671875	2·795166015625	4·673168182373046875
1			11/16	22/32	44/64	1·6875	2·84765625	4·805419921875
1					45/64	1·703125	2·900634765625	4·940143585205078125
1				23/32	46/64	1·71875	2·9541015625	5·077362060546875
1					47/64	1·734375	3·008056640625	5·217098236083984375
1	3/4	6/8	12/16	24/32	48/64	1·75	3·0625	5·359375
1					49/64	1·765625	3·117431640625	5·504215240478515625
1				25/32	50/64	1·78125	3·1728515625	5·651641845703125
1					51/64	1·796875	3·228759765625	5·801677703857421875
1			13/16	26/32	52/64	1·8125	3·28515625	5·954345703125
1					53/64	1·828125	3·342041015625	6·109668731689453125
1				27/32	54/64	1·84375	3·3994140625	6·267669677734375
1					55/64	1·859375	3·457275390625	6·428371429443359375
1		7/8	14/16	28/32	56/64	1·875	3·515625	6·591796875

TABLE No. 196a.

NUMBERS, VULGAR FRACTIONS, DECIMAL EQUIVALENTS, SQUARES AND CUBES.

Fractions.							Equivalents.	Squares.	Cubes.
1						57/64	1·890625	3·574462890625	6·757968902587890625
1					29/32	58/64	1·90625	3·6337890625	6·926910400390625
1						59/64	1·921875	3·693603515625	7·098644256591796875
1				15/16	30/32	60/64	1·9375	3·75390625	7·273193359375
1						61/64	1·953125	3·814697265625	7·450580596923828125
1					31/32	62/64	1·96875	3·8759765625	7·630828857421875
1						63/64	1·984375	3·937744140625	7·813961029052734375
2							2	4	8
2					1/32		2·03125	4·1259765625	8·380889892578125
2				1/16	2/32		2·0625	4·25390625	8·773681640625
2					3/32		2·09375	4·3837890625	9·178558349609375
2			1/8	2/16	4/32		2·125	4·515625	9·595703125
2					5/32		2·15625	4·6494140625	10·025299072265625
2				3/16	6/32		2·1875	4·78515625	10·467529296875
2					7/32		2·21875	4·9228515625	10·922576904296875
2		1/4	2/8	4/16	8/32		2·25	5·0625	11·390625
2					9/32		2·28125	5·2041015625	11·871856689453125
2				5/16	10/32		2·3125	5·34765625	12·366455078125
2					11/32		2·34375	5·4931640625	12·874603271484375
2			3/8	6/16	12/32		2·375	5·640625	13·396484375
2					13/32		2·40625	5·7900390625	13·932281494140625
2				7/16	14/32		2·4375	5·94140625	14·482177734375
2					15/32		2·46875	6·0947265625	15·046356201171875
2	1/2	2/4	4/8	8/16	16/32		2·5	6·25	15·625
2					17/32		2·53125	6·4072265625	16·218292236328125

TABLE No. 197.

NUMBERS, VULGAR FRACTIONS, DECIMAL EQUIVALENTS, SQUARES AND CUBES.

Fractions.					Equivalents.	Squares.	Cubes.
2			9/16	18/32	2·5625	6·56640625	16·826416015625
2				19/32	2·59375	6·7275390625	17·449554443359375
2		5/8	10/16	20/32	2·625	6·890625	18·087890625
2				21/32	2·65625	7·0556640625	18·741607666015625
2			11/16	22/32	2·6875	7·22265625	19·410888671875
2				23/32	2·71875	7·3916015625	20·095916748046875
2	3/4	6/8	12/16	24/32	2·75	7·5625	20·796875
2				25/32	2·78125	7·7353515625	21·513946533203125
2			13/16	26/32	2·8125	7·91015625	22·247314453125
2				27/32	2·84375	8·0869140625	22·997161865234375
2		7/8	14/16	28/32	2·875	8·265625	23·763671875
2				29/32	2·90625	8·4462890625	24·547027587890625
2			15/16	30/32	2·9375	8·62890625	25·347412109375
2				31/32	2·96875	8·8134765625	26·165008544921875
3					3	9	27
3				1/32	3·03125	9·1884765625	27·852569580078125
3			1/16	2/32	3·0625	9·37890625	28·722900390625
3				3/32	3·09375	9·5712890625	29·611175537109375
3		1/8	2/16	4/32	3·125	9·765625	30·517578125
3				5/32	3·15625	9·9619140625	31·442291259765625
3			3/16	6/32	3·1875	10·1601562	32·385498046875
3				7/32	3·21875	10·3603515625	33·347381591796875
3	1/4	2/8	4/16	8/32	3·25	10·5625	34·328125
3				9/32	3·28125	10·7666015625	35·327911376953125
3			5/16	10/32	3·3125	10·97265625	36·346923828125

NUMBERS, VULGAR FRACTIONS, SQUARES AND CUBES. TABLE No. 197*a*.

Numbers and Fractions.	Squares.	Cubes.	Numbers and Fractions.	Squares.	Cubes.	Numbers and Fractions.	Squares.	Cubes.
3 11/32	11·181	37·385	4 1/8	17·016	70·189	4 29/32	24·071	118·100
3 3/8	11·391	38·443	4 5/32	17·274	71·797	4 15/16	24·379	120·371
3 13/32	11·603	39·521	4 3/16	17·535	73·428	4 31/32	24·688	122·671
3 7/16	11·816	40·619	4 7/32	17·798	75·085	5	25	125
3 15/32	12·032	41·737	4 1/4	18·062	76·766	5 1/32	25·313	127·358
3 1/2	12·25	42·875	4 9/32	18·329	78·471	5 1/16	25·629	129·746
3 17/32	12·470	44·034	4 5/16	18·598	80·202	5 3/32	25·946	132·164
3 9/16	12·691	45·213	4 11/32	18·868	81·959	5 1/8	26·266	134·611
3 19/32	12·915	46·413	4 3/8	19·141	83·740	5 5/32	26·587	137·089
3 5/8	13·141	47·635	4 13/32	19·415	85·548	5 3/16	26·910	139·596
3 21/32	13·368	48·877	4 7/16	19·691	87·381	5 7/32	27·235	142·134
3 11/16	13·598	50·141	4 15/32	19·970	89·240	5 1/4	27·562	144·703
3 23/32	13·829	51·427	4 1/2	20·25	91·125	5 9/32	27·892	147·303
3 3/4	14·062	52·734	4 17/32	20·532	93·037	5 5/16	28·223	149·933
3 25/32	14·298	54·064	4 9/16	20·816	94·975	5 11/32	28·556	152·594
3 13/16	14·535	55·415	4 19/32	21·103	96·940	5 3/8	28·891	155·287
3 27/32	14·774	56·789	4 5/8	21·391	98·932	5 13/32	29·228	158·011
3 7/8	15·016	58·186	4 21/32	21·681	100·951	5 7/16	29·566	160·767
3 29/32	15·259	59·605	4 11/16	21·973	102·997	5 15/32	29·907	163·555
3 15/16	15·504	61·047	4 23/32	22·267	105·071	5 1/2	30·25	166·375
3 31/32	15·751	62·512	4 3/4	22·562	107·172	5 17/32	30·595	169·227
4	16	64	4 25/32	22·860	109·301	5 9/16	30·941	172·112
4 1/32	16·251	65·512	4 13/16	23·160	111·458	5 19/32	31·290	175·029
4 1/16	16·504	67·047	4 27/32	23·462	113·644	5 5/8	31·641	177·979
4 3/32	16·759	68·606	4 7/8	23·766	115·857	5 21/32	31·993	180·961

NUMBERS, VULGAR FRACTIONS, SQUARES AND CUBES.

Numbers and Fractions.	Squares.	Cubes.	Numbers and Fractions.	Squares.	Cubes.	Numbers and Fractions.	Squares.	Cubes.
$5\frac{11}{16}$	32·348	183·977	$6\frac{15}{16}$	48·129	333·894	$8\frac{1}{2}$	72·25	614·125
$5\frac{23}{32}$	32·704	187·027	7	49	343	$8\frac{9}{16}$	73·316	627·772
$5\frac{3}{4}$	33·062	190·109	$7\frac{1}{16}$	49·879	352·270	$8\frac{5}{8}$	74·391	641·619
$5\frac{25}{32}$	33·423	193·226	$7\frac{1}{8}$	50·766	361·705	$8\frac{11}{16}$	75·473	655·669
$5\frac{13}{16}$	33·785	196·376	$7\frac{3}{16}$	51·660	371·307	$8\frac{3}{4}$	76·562	669·922
$5\frac{27}{32}$	34·149	199·561	$7\frac{1}{4}$	52·562	381·078	$8\frac{13}{16}$	77·660	684·380
$5\frac{7}{8}$	34·516	202·779	$7\frac{5}{16}$	53·473	391·019	$8\frac{7}{8}$	78·766	699·045
$5\frac{29}{32}$	34·884	206·032	$7\frac{3}{8}$	54·391	401·131	$8\frac{15}{16}$	79·879	713·918
$5\frac{15}{16}$	35·254	209·320	$7\frac{7}{16}$	55·316	411·416	9	81	729
$5\frac{31}{32}$	35·626	212·643	$7\frac{1}{2}$	56·25	421·875	$9\frac{1}{16}$	82·129	744·293
6	36	216	$7\frac{9}{16}$	57·191	432·510	$9\frac{1}{8}$	83·266	759·799
$6\frac{1}{16}$	36·754	222·821	$7\frac{5}{8}$	58·141	443·322	$9\frac{3}{16}$	84·410	775·518
$6\frac{1}{8}$	37·516	229·783	$7\frac{11}{16}$	59·098	454·313	$9\frac{1}{4}$	85·562	791·453
$6\frac{3}{16}$	38·285	236·889	$7\frac{3}{4}$	60·062	465·484	$9\frac{5}{16}$	86·723	807·605
$6\frac{1}{4}$	39·062	244·141	$7\frac{13}{16}$	61·035	476·837	$9\frac{3}{8}$	87·891	823·975
$6\frac{5}{16}$	39·848	251·538	$7\frac{7}{8}$	62·016	488·373	$9\frac{7}{16}$	89·066	840·564
$6\frac{3}{8}$	40·641	259·084	$7\frac{15}{16}$	63·004	500·094	$9\frac{1}{2}$	90·25	857·375
$6\frac{7}{16}$	41·441	266·779	8	64	512	$9\frac{9}{16}$	91·441	874·408
$6\frac{1}{2}$	42·25	274·625	$8\frac{1}{16}$	65·004	524·094	$9\frac{5}{8}$	92·641	891·666
$6\frac{9}{16}$	43·066	282·623	$8\frac{1}{8}$	66·016	536·377	$9\frac{11}{16}$	93·848	909·149
$6\frac{5}{8}$	43·891	290·775	$8\frac{3}{16}$	67·035	548·850	$9\frac{3}{4}$	95·062	926·859
$6\frac{11}{16}$	44·723	299·083	$8\frac{1}{4}$	68·062	561·516	$9\frac{13}{16}$	96·285	944·798
$6\frac{3}{4}$	45·562	307·547	$8\frac{5}{16}$	69·098	574·374	$9\frac{7}{8}$	97·516	962·967
$6\frac{13}{16}$	46·410	316·169	$8\frac{3}{8}$	70·141	587·428	$9\frac{15}{16}$	98·754	981·367
$6\frac{7}{8}$	47·266	324·951	$8\frac{7}{16}$	71·191	600·677	10	100	1000

NUMBERS, VULGAR FRACTIONS, SQUARES AND CUBES. TABLE No. 198*a*.

Numbers and Fractions.	Squares.	Cubes.	Numbers and Fractions.	Squares.	Cubes.	Numbers and Fractions.	Squares.	Cubes.
10 1/16	101·254	1018·867	11 5/8	135·141	1571·010	14 3/8	206·641	2970·459
10 1/8	102·516	1037·971	11 11/16	136·598	1596·485	14 1/2	210·25	3048·625
10 3/16	103·785	1057·311	11 3/4	138·062	1622·234	14 5/8	213·891	3128·150
10 1/4	105·062	1076·891	11 13/16	139·535	1648·259	14 3/4	217·562	3209·047
10 5/16	106·348	1096·710	11 7/8	141·016	1674·561	14 7/8	221·266	3291·326
10 3/8	107·641	1116·771	11 15/16	142·504	1701·140	15	225	3375
10 7/16	108·941	1137·076	12	144	1728	15 1/8	228·766	3460·080
10 1/2	110·25	1157·625	12 1/8	147·016	1782·564	15 1/4	232·562	3546·578
10 9/16	111·566	1178·420	12 1/4	150·062	1838·266	15 3/8	236·391	3634·506
10 5/8	112·891	1199·463	12 3/8	153·141	1895·115	15 1/2	240·25	3723·875
10 11/16	114·223	1220·755	12 1/2	156·25	1953·125	15 5/8	244·141	3814·697
10 3/4	115·562	1242·297	12 5/8	159·391	2012·307	15 3/4	248·062	3906·984
10 13/16	116·910	1264·091	12 3/4	162·562	2072·672	15 7/8	252·016	4000·748
10 7/8	118·266	1286·139	12 7/8	165·766	2134·232	16	256	4096
10 15/16	119·629	1308·441	13	169	2197	16 1/8	260·016	4192·752
11	121	1331	13 1/8	172·266	2260·986	16 1/4	264·062	4291·016
11 1/16	122·379	1353·817	13 1/4	175·562	2326·203	16 3/8	268·141	4390·803
11 1/8	123·766	1376·893	13 3/8	178·891	2392·662	16 1/2	272·25	4492·125
11 3/16	125·160	1400·229	13 1/2	182·25	2460·375	16 5/8	276·391	4594·994
11 1/4	126·562	1423·828	13 5/8	185·641	2529·354	16 3/4	280·562	4699·422
11 5/16	127·973	1447·691	13 3/4	189·062	2599·609	16 7/8	284·766	4805·420
11 3/8	129·391	1471·818	13 7/8	192·516	2671·154	17	289	4913
11 7/16	130·816	1496·213	14	196	2744	17 1/8	293·266	5022·174
11 1/2	132·25	1520·875	14 1/8	199·516	2818·158	17 1/4	297·562	5132·953
11 9/16	133·691	1545·807	14 1/4	203·062	2893·641	17 3/8	301·891	5245·350

NUMBERS, VULGAR FRACTIONS, SQUARES AND CUBES. TABLE No. 199.

Numbers and Fractions.	Squares.	Cubes.	Numbers and Fractions.	Squares.	Cubes.	Numbers and Fractions.	Squares.	Cubes.
17½	306·25	5359·375	20¾	430·562	8934·172	24	576	13824
17⅝	310·641	5475·041	20⅞	435·766	9096·607	24¼	588·062	14260·516
17¾	315·062	5592·359	21	441	9261	24½	600·25	14706·125
17⅞	319·516	5711·342	21⅛	446·266	9427·361	24¾	612·562	15160·922
18	324	5832	21¼	451·562	9595·703	25	625	15625
18⅛	328·516	5954·346	21⅜	456·891	9766·037	25¼	637·562	16098·453
18¼	333·062	6078·391	21½	462·25	9938·375	25½	650·25	16581·375
18⅜	337·641	6204·146	21⅝	467·641	10112·729	25¾	663·062	17073·859
18½	342·25	6331·625	21¾	473·062	10289·109	26	676	17576
18⅝	346·891	6460·838	21⅞	478·516	10467·529	26¼	689·062	18087·891
18¾	351·562	6591·797	22	484	10648	26½	702·25	18609·625
18⅞	356·266	6724·514	22⅛	489·516	10830·533	26¾	715·562	19141·297
19	361	6859	22¼	495·062	11015·141	27	729	19683
19⅛	365·766	6995·268	22⅜	500·641	11201·834	27¼	742·562	20234·828
19¼	370·562	7133·328	22½	506·25	11390·625	27½	756·25	20796·875
19⅜	375·391	7273·193	22⅝	511·891	11581·525	27¾	770·062	21369·234
19½	380·25	7414·875	22¾	517·562	11774·547	28	784	21952
19⅝	385·141	7558·385	22⅞	523·266	11969·701	28¼	798·062	22545·266
19¾	390·062	7703·734	23	529	12167	28½	812·25	23149·125
19⅞	395·016	7850·936	23⅛	534·766	12366·455	28¾	826·562	23763·672
20	400	8000	23¼	540·562	12568·078	29	841	24389
20⅛	405·016	8150·939	23⅜	546·391	12771·881	29¼	855·562	25025·203
20¼	410·062	8303·766	23½	552·25	12977·875	29½	870·25	25672·375
20⅜	415·141	8458·490	23⅝	558·141	13186·072	29¾	885·062	26330·609
20½	420·25	8615·125	23¾	564·062	13396·484			
20⅝	425·391	8773·682	23⅞	570·016	13609·123			

INCHES AND THEIR EQUIVALENT DECIMALS OF A FOOT. TABLE No. 200.

Inches.	Equivalents.	Inches.	Equivalents.	Inches.	Equivalents.	Inches.	Equivalents.	Inches.	Equivalents.
1/64	·001302083	5/16	·0260416	39/64	·05078125	29/32	·07552083	1 13/32	·1171875
1/32	·00260416	21/64	·02734375	5/8	·052083	59/64	·076822916	1 7/16	·1197916
3/64	·00390625	11/32	·02864583	41/64	·053385416	15/16	·078125	1 15/32	·12239583
1/16	·0052083	23/64	·029947916	21/32	·0546875	61/64	·079427083	1 1/2	·125
5/64	·006510416	3/8	·03125	43/64	·055989583	31/32	·08072916	1 17/32	·12760416
3/32	·0078125	25/64	·032552083	11/16	·0572916	63/64	·08203125	1 9/16	·1302083
7/64	·009114583	13/32	·03385416	45/64	·05859375	1	·083	1 19/32	·1328125
1/8	·010416	27/64	·03515625	23/32	·05989583	1 1/32	·0859375	1 5/8	·135416
9/64	·01171875	7/16	·0364583	47/64	·061197916	1 1/16	·0885416	1 21/32	·13802083
5/32	·01302083	29/64	·037760416	3/4	·0625	1 3/32	·09114583	1 11/16	·140625
11/64	·014322916	15/32	·0390625	49/64	·063802083	1 1/8	·09375	1 23/32	·14322916
3/16	·015625	31/64	·040364583	25/32	·06510416	1 5/32	·09635416	1 3/4	·14583
13/64	·016927083	1/2	·0416	51/64	·06640625	1 3/16	·0989583	1 25/32	·1484375
7/32	·01822916	33/64	·04296875	13/16	·0677083	1 7/32	·1015625	1 13/16	·1510416
15/64	·01953125	17/32	·04427083	53/64	·069010416	1 1/4	·10416	1 27/32	·15364583
1/4	·02083	35/64	·045572916	27/32	·0703125	1 9/32	·10677083	1 7/8	·15625
17/64	·022135416	9/16	·046875	55/64	·071614583	1 5/16	·109375	1 29/32	·15885416
9/32	·0234375	37/64	·048177083	7/8	·072916	1 11/32	·11197916	1 15/16	·1614583
19/64	·024739583	19/32	·04947916	57/64	·07421875	1 3/8	·114583	1 31/32	·1640625

When 5 is the last decimal figure the equivalent is exact, but when the last figure is 3 or 6 such figures are respectively repeating ones.

INCHES AND THEIR EQUIVALENT DECIMALS OF A FOOT. TABLE NO. 200—*continued.*

Inches.	Equivalents.	Inches.	Equivalents.	Inches.	Equivalents.	Inches.	Equivalents.	Inches.	Equivalents.
2	·16	3¼	·27083	5½	·4583	7¾	·64583	10	·8333
2 1/16	·171875	3⅜	·28125	5⅝	·46875	7⅞	·65625	10⅛	·84375
2 ⅛	·177083	3½	·2916	5¾	·47916	8	·6666	10¼	·85416
2 3/16	·1822916	3⅝	·302083	5⅞	·489583	8⅛	·677083	10⅜	·864583
2 ¼	·1875	3¾	·3125	6	·5	8¼	·6875	10½	·875
2 5/16	·1927083	3⅞	·322916	6⅛	·510416	8⅜	·697916	10⅝	·885416
2 ⅜	·197916	4	·3333	6¼	·52083	8½	·7083	10¾	·89583
2 7/16	·203125	4⅛	·34375	6⅜	·53125	8⅝	·71875	10⅞	·90625
2 ½	·2083	4¼	·35416	6½	·5416	8¾	·72916	11	·916
2 9/16	·2135416	4⅜	·364583	6⅝	·552083	8⅞	·739583	11⅛	·927083
2 ⅝	·21875	4½	·375	6¾	·5625	9	·75	11¼	·9375
2 11/16	·2239583	4⅝	·385416	6⅞	·572916	9⅛	·760416	11⅜	·947916
2 ¾	·22916	4¾	·39583	7	·583	9¼	·77083	11½	·9583
2 13/16	·234375	4⅞	·40625	7⅛	·59375	9⅜	·78125	11⅝	·96875
2 ⅞	·239583	5	·416	7¼	·60416	9½	·7916	11¾	·97916
2 15/16	·2447916	5⅛	·427083	7⅜	·614583	9⅝	·802083	11⅞	·989583
3	·25	5¼	·4375	7½	·625	9¾	·8125	...	...
3 ⅛	·260416	5⅜	·447916	7⅝	·635416	9⅞	·822916	...	...

When 5 is the last decimal figure the equivalent is exact, but when the last figure is 3 or 6 such figures are respectively repeating ones.

TABLE No. 201.

DECIMAL FRACTIONS AND THEIR APPROXIMATE VALUES, &c., IN VULGAR FRACTIONS.

From ·01 to 99 advancing by ·01.

Decimals.	Nearest Vulgar Fractions	Greater than	Less than	Decimals.	Nearest Vulgar Fractions.	Greater than	Less than	Decimals.	Nearest Vulgar Fractions.	Greater than.	Less than	Decimals.	Nearest Vulgar Fractions.	Greater than	Less than	Decimals.	Nearest Vulgar Fractions.	Greater than	Less than.
·01	1/64	...	1/64	·21	13/64	13/64	7/32	·41	13/32	13/32	27/64	·61	39/64	39/64	5/8	·81	13/16	51/64	13/16
·02	1/64	1/64	1/32	·22	7/32	7/32	15/64	·42	27/64	13/32	27/64	·62	5/8	39/64	5/8	·82	13/16	13/16	53/64
·03	1/32	1/64	1/32	·23	15/64	7/32	15/64	·43	7/16	27/64	7/16	·63	5/8	5/8	41/64	·83	53/64	53/64	27/32
·04	3/64	1/32	3/64	·24	15/64	15/64	1/4	·44	7/16	7/16	29/64	·64	41/64	5/8	41/64	·84	27/32	53/64	27/32
·05	3/64	3/64	1/16	·25	1/4	...	...	·45	29/64	7/16	29/64	·65	21/32	41/64	21/32	·85	27/32	27/32	55/64
·06	1/16	3/64	1/16	·26	17/64	1/4	17/64	·46	29/64	29/64	15/32	·66	21/32	21/32	43/64	·86	55/64	55/64	7/8
·07	1/16	1/16	5/64	27	17/64	17/64	9/32	·47	15/32	15/32	31/64	·67	43/64	21/32	43/64	·87	7/8	55/64	7/8
·08	5/64	5/64	3/32	·28	9/32	17/64	9/32	·48	31/64	15/32	31/64	·68	11/16	43/64	11/16	·88	7/8	7/8	57/64
·09	3/32	5/64	3/32	·29	19/64	9/32	19/64	·49	31/64	31/64	1/2	·69	11/16	11/16	45/64	·89	57/64	7/8	57/64
·1	3/32	3/32	7/64	·3	19/64	19/64	5/16	·5	1/2	...	...	·7	45/64	11/16	45/64	·9	29/32	57/64	29/32
·11	7/64	7/64	1/8	·31	5/16	19/64	5/16	·51	33/64	1/2	33/64	·71	45/64	45/64	23/32	·91	29/32	29/32	59/64
·12	1/8	7/64	1/8	·32	5/16	5/16	21/64	·52	33/64	33/64	17/32	·72	23/32	23/32	47/64	·92	59/64	29/32	59/64
·13	1/8	1/8	9/64	·33	21/64	21/64	11/32	·53	17/32	33/64	17/32	·73	47/64	23/32	47/64	·93	15/16	59/64	15/16
·14	9/64	1/8	9/64	·34	11/32	21/64	11/32	·54	35/64	17/32	35/64	·74	47/64	47/64	3/4	·94	15/16	15/16	61/64
·15	5/32	9/64	5/32	·35	11/32	11/32	23/64	·55	35/64	35/64	9/16	·75	3/4	...	...	·95	61/64	15/16	61/64
·16	5/32	5/32	11/64	·36	23/64	23/64	3/8	·56	9/16	35/64	9/16	·76	49/64	3/4	49/64	·96	61/64	61/64	31/32
·17	11/64	5/32	11/64	·37	3/8	23/64	3/8	·57	9/16	9/16	37/64	·77	49/64	49/64	25/32	·97	31/32	31/32	63/64
·18	3/16	11/64	3/16	·38	3/8	3/8	25/64	·58	37/64	37/64	19/32	·78	25/32	49/64	25/32	·98	63/64	31/32	63/64
·19	3/16	3/16	13/64	·39	25/64	3/8	25/64	·59	19/32	37/64	19/32	·79	51/64	25/32	51/64	·99	63/64	63/64	1
·2	13/64	3/16	13/64	·4	13/32	25/64	13/32	·6	19/32	19/32	39/64	·8	51/64	51/64	13/16				

This Table will be found convenient for converting the decimals given in many of the tables into vulgar fractions.

FOURTH POWERS

The fourth powers as given in the following Table, No. 202, in the columns headed Fourth Powers, are complete for the whole numbers, and also for all the others *except* when the fourth or terminal decimal is 4 or 9.

When the fourth or terminal decimal in the column headed Fourth Powers is 4 or 9, if 0625 be placed after the last figure, 4 or 9 as the case may be, the fourth power is completed; but in many cases the fourth power, as given to four decimals, is sufficiently accurate.

The following notes will facilitate calculating the fourth powers of numbers not given in the table :—

The fourth power of any given number, multiplied by 16, equals the fourth power of double the given number.

The fourth power of a given number, divided by 16, equals the fourth power of half the given number.

The fourth power of a number, multiplied by 81, equals the fourth power of three times the given number.

The fourth power of a number, divided by 81, equals the fourth power of one third the given number.

Or the following embraces all cases :—

If N equals any given number and F equals the fourth power of N, the fourth power of any multiple of N may be found by multiplying F by the fourth power of the given multiple of N; for example :—

If the multiple of N be 2, multiply F by 16, which is the fourth power of 2 ; if 3 N by 81, which is the fourth power of 3 ; and if the multiple of N be 10, F should be multiplied by 10000, as it is the fourth power of 10.

The fourth power table among other uses may be found convenient when dealing with spiral springs.

FOURTH POWERS.

Nos.	Fourth Powers.	Nos.	Fourth Powers.	Nos	Fourth Powers.
1	1	11·5	17490·0625	22	234256
1·25	2·4414	11·75	19061·2539	22·25	245086·8789
1·5	5·0625	12	20736	22·5	256289·0625
1·75	9·3789	12·25	22518·7539	22·75	267870·9414
2	16	12·5	24414·0625	23	279841
2·25	25·6289	12·75	26426·5664	23·25	292207·8164
2·5	39·0625	13	28561	23·5	304980·0625
2·75	57·1914	13·25	30822·1914	23·75	318166·5039
3	81	13·5	33215·0625	24	331776
3·25	111·5664	13·75	35744·6289	24·25	345817·5039
3·5	150·0625	14	38416	24·5	360300·0625
3·75	197·7539	14·25	41234·3789	24·75	375232·8164
4	256	14·5	44205·0625	25	390625
4·25	326·2539	14·75	47333·4414	25·25	406485·9414
4·5	410·0625	15	50625	25·5	422825·0625
4·75	509·0664	15·25	54085·3164	25·75	439651·8789
5	625	15·5	57720·0625	26	456976
5·25	759·6914	15·75	61535·0039	26·25	474807·1289
5·5	915·0625	16	65536	26·5	493155·0625
5·75	1093·1289	16·25	69729·0039	26·75	512029·6914
6	1296	16·5	74120·0625	27	531441
6·25	1525·8789	16·75	78715·3164	27·25	551399·0664
6·5	1785·0625	17	83521	27·5	571914·0625
6·75	2075·9414	17·25	88543·4414	27·75	592996·2539
7	2401	17·5	93789·0625	28	614656
7·25	2762·8164	17·75	99264·3789	28·25	636903·7539
7·5	3164·0625	18	104976	28·5	659750·0625
7·75	3607·5039	18·25	110930·6289	28·75	683205·5664
8	4096	18·5	117135·0625	29	707281
8·25	4632·5039	18·75	123596·1914	29·25	731987·1914
8·5	5220·0625	19	130321	29·5	757335·0625
8·75	5861·8164	19·25	137316·5664	29·75	783335·6289
9	6561	19·5	144590·0625	30	810000
9·25	7320·9414	19·75	152148·7539	30·25	837339·3789
9·5	8145·0625	20	160000	30·5	865365·0625
9·75	9036·8789	20·25	168151·2539	30·75	894088·4414
10	10000	20·5	176610·0625	31	923521
10·25	11038·1289	20·75	185384·0664	31·25	953674·3164
10·5	12155·0625	21	194481	31·5	984560·0625
10·75	13354·6914	21·25	203908·6914	31·75	1016190·0039
11	14641	21·5	213675·0625	32	1048576
11·25	16018·0664	21·75	223788·1289		

WEIGHTS AND MEASURES, &c.

Following these notes are Tables of Imperial and Metric Weights and Measures and equivalents.

There is a bronze bar deposited in London which is marked, and the standard yard is based on the distance between these marks when the bar is at the temperature of 62 degrees Fahrenheit, or about 16·66 degrees Centigrade, or about 13·33 degrees Réaumur.

A piece of platinum, which is also deposited in London, is taken as the standard pound, when weighed *in vacuo* at the temperature of 32 degrees Fahrenheit, or 0 degrees Centigrade, or 0 degrees Réaumur.

A cubic foot of distilled water weighs 62·321 lbs.

A gallon of distilled water weighs 10 lbs., or about 4·5359265 kilogrammes, when the barometer is at 30 inches, or about 761·9862339 millimetres, in the latitude of London at about the sea level, and the temperature is at 62 degrees Fahrenheit, or 13·33 degrees Réaumur, or 16·66 degrees Centigrade.

The weight of a cubic inch of distilled water is taken at 252·458 grains.

The capacity of a gallon is taken at 277·274 cubic inches.

For ordinary purposes, *not legal equivalents,* the weight of a cubic foot of fresh water, not distilled, may be taken at 62·5 lbs., and the weight of a cubic foot of sea water at 64 lbs., and a ton of sea water may be considered as equal to 35 cubic feet, and to about 218·12 gallons, and a cubic foot to about 6·232 gallons.

In Paris there is a platinum bar, known as the "Mètre des Archives," and when the bar is at the temperature of 0 degrees Centigrade, or 0 degrees Réaumur, or 32 degrees Fahrenheit, it is taken as the length of the metre.

39·37079 inches is the legal equivalent of the metre, but were a brass metre compared at the temperature of 62 degrees Fahrenheit (and not at 0 degrees Centigrade, which is the legal temperature) with a bronze yard at the same temperature, viz., 62 degrees Fahrenheit, the apparent equivalent of the metre is nearly 39·382 inches.

A piece of platinum deposited in Paris, known as the "Kilogramme des Archives," when weighed *in vacuo* at 0 degrees Centigrade, or 0 degrees Réaumur, or 32 degrees Fahrenheit, is taken as the weight of the kilogramme.

The litre, or cubic decimetre, when the barometer is at 760 millimetres, or about 29·9218004 inches, contains one kilogramme weight of distilled water at its maximum density of 4 degrees Centigrade, or 3·2 degrees Réaumur, or 39·2 degrees Fahrenheit.

Imperial and Metric Weights and Measures.

Linear Measure.

1 Inch, ...	=	25·39954113 millimetres.
1 Foot (12 inches), . . .	=	·30479449 metre.
1 Yard (3 feet), ...	=	·91438348 ,,
1 Pole (5½ yards), . . .	=	5·02911 metres.
1 Chain (22 yards or 100 links),	=	20·11644 ,,
1 Furlong (220 yards), . .	=	201·16437 ,,
1 Mile (1760 yards), . . .	=	1·60931493 kilometres.

Square Measure.

1 Square inch, ...	=	6·45137 square centimetres.
1 Square foot (144 square inches),	=	9·28997 square decimetres.
1 Square yard (9 square feet), .	=	·83609715 square metre.
1 Perch (30¼ square yards), .	=	25·29194 ,,
1 Rood (40 perches), . . .	=	10·11678 acres.
1 Acre (4840 square yards), .	=	·40467 hectare.
1 Square mile (640 acres), .	=	258·98945312 hectares.

Cubic Measure.

1 Cubic inch, ...	=	16·38617589 cubic centimetres.
1 Cubic foot (1728 cubic inches),	=	·02832 cubic metre, or 28·31531 cubic decimetres.
1 Cubic yard (27 cubic feet), .	=	·76451342 cubic metre.

Apothecaries' Measure.

1 Gallon* (8 pints or 160 fluid ounces), ...	=	4·54346 litres.
1 Fluid ounce f℥ (8 drachms), .	=	28·39661 cubic centimetres.
1 Fluid drachm, fʒ (60 minims),	=	3·54958 ,,
1 Minim, ♏ (0·91146 grain weight), ...	=	·05916 ,,

Measure of Capacity.

1 Gill, ...	=	1·41983 decilitres.
1 Pint (4 gills), ...	=	·56793 litre.
1 Quart (2 pints), ...	=	1·13586 litres.
1 Gallon (4 quarts), . . .	=	4·54345797 litres.
1 Peck (2 gallons), ...	=	9·08692 ,,
1 Bushel (8 gallons), . . .	=	3·63477 dekalitres.
1 Quarter (8 bushels), . .	=	2·90781 hectolitres.

* The apothecaries' gallon is of the same capacity as the imperial gallon.

Avoirdupois Weight.

1 Grain, ...	=	64·79895036 milligrammes.
1 Drachm, ...	=	1·77185 grammes.
1 Ounce (16 drachms), . .	=	28·34954 ,,
1 Pound (16 ounces or 7000 grains),	=	·45359265 kilogramme.
1 Stone (14 pounds), ...	=	6·35030 ,,
1 Quarter (28 pounds), . .	=	12·70059 ,,
1 Hundredweight (112 lbs.), .	=	50·80238 ,, or ·50802 quintal.
1 Ton (20 cwt.), ...	=	1·01604754 millier or tonne.

Troy Weight.

1 Troy ounce (480 grains* avoirdupois), ...	=	31·10350 grammes.
1 Pennyweight (24 grains*), .	=	1·55517 ,,

Apothecaries' Weight.

1 Ounce† (8 drachms), . .	=	31·10350 grammes.
1 Drachm ʒi (3 scruples), . .	=	3·88794 ,,
1 Scruple ℈i (20 grains), . .	=	1·29598 ,,

Metric and Imperial Weights and Measures.

Linear Measure.

1 Millimetre (·001 m.), . .	=	·03937 inch.
1 Centimetre (·01 ,,), . .	=	·39371 ,,
1 Decimetre (·1 ,,), . .	=	3·93708 inches
1 Metre, ...	=	39·37079 ,, 3·28089917 feet. 1·09363306 yards.
1 Decametre (10 m.), . .	=	10·93633 ,,
1 Hectometre (100 ,,), . .	=	109·36331 ,,
1 Kilometre (1000 ,,), . .	=	·62138 mile.
1 Myriameter (10000 ,,), . .	=	6·21382 miles.
1 Micron, ...	=	·001 mm.

Square Measure.

1 Square centimetre, . . .	=	·15501 square inch.
1 Square decimeter (100 square centimetres), . . .	=	15·50059 square inches.
1 Square metre or centiare (100 square decimetres), . .	=	10·76430 square feet. 1·19603 square yards.
1 Are (100 square metres), . .	=	119·60333 square yards.
1 Hectare (100 ares or 10000 square metres), . . .	=	2·47114 acres.

* The troy grain is of the same weight as the avoirdupois grain.

† The apothecaries' ounce is of the same weight as the troy ounce. The apothecaries' grain is also of the same weight as the avoirdupois grain.

Cubic Measure.

1 Cubic centimetre (1000 cubic millimetres), . . .	=	·06103 cubic inch.
1 Cubic decimetre (1000 cubic centimetres), . . .	=	61·02705 cubic inches.
1 Cubic metre or stere (1000 cubic decimetres), . .	=	35·31658074 cubic feet. 1·30802151 cubic yard

Measure of Capacity.

1 Centilitre (·01 litre), . .	=	·07043 gill.
1 Decilitre (·1 ,,), . .	=	·17608 pint.
1 Litre or 1000 cubic centimetres or 1 cubic decimetre, . .	=	1·76077 pints.
1 Dekalitre (10 litres), . .	=	2·20097 gallons.
1 Hectolitre (100 ,,), . .	=	2·75121 bushels.
1 Kilolitre (1000 ,,), . .	=	3·43901 quarters

Apothecaries' Measure.

1 Cubic centimetre, or 1 gramme weight, ...	=	·03527 fluid ounce. ·28219 fluid drachm, or 15·43235 grains weight.
1 Cubic millimetre, . . .	=	·01693 minim

Weight.		*Avoirdupois.*
1 Milligramme (·001 gramme), .	=	·01543 grain.
1 Centigramme (·01 ,,), .	=	·15432 ,,
1 Decigramme (·1 ,,), .	=	1·54324 grains.
1 Gramme, ...	=	15·43235 ,,
1 Dekagramme (10 grammes),	=	5·64383 drams.
1 Hectogramme (100 ,,),	=	3·52739 ounces.
1 Kilogramme (1000 ,,),	=	2·20462125 lbs., or 15432·34874 grains.
1 Myriagramme (10 kilos.), .	=	22·04621 lbs.
1 Quintal (100 ,,), .	=	1·96841 cwt.
1 Millier or tonne (1000 ,,), .	=	·98420591 ton.

		Troy.
1 Gramme, ...	=	·03215073 ounce troy. ·64301 pennyweight. 15·43235 grains.

		Apothecaries'.
1 Gramme, . . .	=	·25721 drachm. ·77162 scruple. 15·43235 grains.

IMPERIAL AND METRIC WEIGHTS AND MEASURES, EQUIVALENTS.

Linear Measure.

	Inches to Millimetres.	Feet to Metres.	Yards to Metres.	Miles to Kilometres.
1 =	25·39954113	·30479	·91438	1·60931
2 =	50·79908226	·60959	1·82877	3·21863
3 =	76·19862340	·91438	2·74315	4·82794
4 =	101·59816453	1·21918	3·65753	6·43726
5 =	126·99770566	1·52397	4·57192	8·04657
6 =	152·39724679	1·82876	5·48630	9·65589
7 =	177·79678792	2·13356	6·40068	11·26520
8 =	203·19632906	2·43835	7·31507	12·87452
9 =	228·59587019	2·74315	8·22945	14·48383

Square Measure.

	Square Inches to Square Centimetres.	Square Feet to Square Decimetres.	Square Yards to Square Metres.	Acres to Hectares.
1 =	6·45137	9·28997	·83610	·40467
2 =	12·90273	18·57994	1·67219	·80934
3 =	19·35410	27·86990	2·50829	1·21401
4 =	25·80547	37·15987	3·34439	1·61868
5 =	32·25683	46·44984	4·18049	2·02336
6 =	38·70820	55·73981	5·01658	2·42803
7 =	45·15957	65·02978	5·85268	2·83270
8 =	51·61094	74·31974	6·68878	3·23737
9 =	58·06230	83·60971	7·52487	3·64204

	Cubic Measure			Apothecaries' Measure.
	Cubic Inches to Cubic Centimetres.	Cubic Feet to Cubic Metres.	Cubic Yards to Cubic Metres.	Fluid Drachms to Cubic Centimetres.
1 =	16·38618	·02832	·76451	3·54958
2 =	32·77235	·05663	1·52903	7·09915
3 =	49·15853	·08495	2·29354	10·64873
4 =	65·54470	·11326	3·05805	14·19831
5 =	81·93088	·14158	3·82257	17·74788
6 =	98·31706	·16989	4·58708	21·29746
7 =	114·70323	·19821	5·35159	24·84704
8 =	131·08941	·22652	6·11611	28·39661
9 =	147·47558	·25484	6·88062	31·94619

IMPERIAL AND METRIC WEIGHTS AND MEASURES, EQUIVALENTS.

Measure of Capacity.

	Quarts to Litres.	Gallons to Litres.	Bushels to Dekalitres.	Quarters to Hectolitres.
1 =	1·13586	4·54346	3·63477	2·90781
2 =	2·27173	9·08692	7·26953	5·81563
3 =	3·40759	13·63037	10·90430	8·72344
4 =	4·54346	18·17383	14·53907	11·63125
5 =	5·67932	22·71729	18·17383	14·53907
6 =	6·81519	27·26075	21·80860	17·44688
7 =	7·95105	31·80421	25·44336	20·35469
8 =	9·08692	36·34766	29·07813	23·26250
9 =	10·22278	40·89112	32·71290	26·17032

Avoirdupois Weight.

	Grains to Milligrammes.	Ounces to Grammes.	Pounds to Kilo-grammes.	Hundred-weights to Quintals.	Tons to Milliers or Tonnes.
1 =	64·79895036	28·34954	·45359	·50802	1·01605
2 =	129·59790072	56·69908	·90719	1·01605	2·03210
3 =	194·39685109	85·04862	1·36078	1·52407	3·04814
4 =	259·19580145	113·39816	1·81437	2·03209	4·06419
5 =	323·99475181	141·74770	2·26796	2·54012	5·08024
6 =	388·79370218	170·09724	2·72156	3·04814	6·09629
7 =	453·59265255	198·44679	3·17515	3·55617	7·11233
8 =	518·39160291	226·79633	3·62874	4·06419	8·12838
9 =	583·19055327	255·14587	4·08233	4 57221	9·14443

	Troy Weight.		Apothecaries' Weight.
	Ounces to Grammes.	Pennyweights to Grammes.	Scruples to Grammes.
1 =	31·10350	1·55517	1·29598
2 =	62·20699	3·11035	2·59196
3 =	93·31059	4·66552	3·88794
4 =	124·41398	6·22070	5·18391
5 =	155·51748	7·77587	6·47989
6 =	186·62098	9·33105	7·77597
7 =	217·72447	10·88622	9·07185
8 =	248·82797	12·44140	10·36783
9 =	279·93147	13·99657	11·66381

METRIC AND IMPERIAL WEIGHTS AND MEASURES, EQUIVALENTS.

Linear Measure.

	Millimetres to Inches.	Metres to Feet.	Metres to Yards.	Kilometres to Miles.
1 =	·03937079	3·28090	1·09363	·62138
2 =	·07874158	6·56180	2·18727	1·24276
3 =	·11811237	9·84270	3·28090	1·86415
4 =	·15748316	13·12360	4·37453	2·48553
5 =	·19685395	16·40450	5·46817	3·10691
6 =	·23622474	19·68540	6·56180	3·72829
7 =	·27559553	22·96629	7·65543	4·34968
8 =	·31496632	26·24719	8·74906	4·97106
9 =	·35433711	29·52809	9·84270	5·59244

Square Measure.

	Square Centimetres to Square Inches.	Square Metres to Square Feet.	Square Meters to Square Yards.	Hectares to Acres.
1 =	·15501	10·76430	1·19603	2·47114
2 =	·31001	21·52860	2·39207	4·94229
3 =	·46502	32·29290	3·58810	7·41343
4 =	·62002	43·05720	4·78413	9·88457
5 =	·77503	53·82150	5·98017	12·35572
6 =	·93004	64·58580	7·17620	14·82686
7 =	1·08504	75·35010	8·37223	17·29800
8 =	1·24005	86·11439	9·56827	19·76914
9 =	1·39505	96·87869	10·76430	22·24029

	Cubic Measure.			Apothecaries' Measure.
	Cubic Decimetres to Cubic Inches.	Cubic Metres to Cubic Feet.	Cubic Metres to Cubic Yards.	Cubic Centimeters to Fluid Drachms.
1 =	61·02705	35·31658	1·30802	·28219
2 =	122·05410	70·63316	2·61604	·56438
3 =	183·08115	105·94974	3·92406	·84657
4 =	244·10821	141·26632	5·23209	1·12877
5 =	305·13526	176·58290	6·54011	1·41096
6 =	366·16231	211·89948	7·84813	1·69315
7 =	427·18936	247·21607	9·15615	1·97534
8 =	488·21641	282·53265	10·46417	2·25753
9 =	549·24346	317·84923	11·77219	2·53972

METRIC AND IMPERIAL WEIGHTS AND MEASURES, EQUIVALENTS.

Measure of Capacity.

	Litres to Pints.	Dekalitres to Gallons.	Hectolitres to Bushels.	Kilolitres to Quarters.
1 =	1·76077	2·20097	2·75121	3·43901
2 =	3·52154	4·40193	5·50242	6·87802
3 =	5·28231	6·60290	8·25362	10·31703
4 =	7·04308	8·80386	11·00483	13·75604
5 =	8·80385	11·00483	13·75604	17·19505
6 =	10·56462	13·20580	16·50725	20·63406
7 =	12·32539	15·40676	19·25846	24·07307
8 =	14·08616	17·60773	22·00966	27·51208
9 =	15·84693	19·80870	24·76087	30·95110

Avoirdupois' Weight.

	Milligrammes to Grains.	Kilogrammes to Grains.	Kilogrammes to Pounds.	Quintals to Hundred-weights.	Milliers or Tonnes to Tons.
1 =	·01543	15432·34874	2·20462	1·96841	·98421
2 =	·03086	30864·69748	4·40924	3·93682	1·96841
3 =	·04630	46297·04622	6·61386	5·90523	2·95262
4 =	·06173	61729·39496	8·81849	7·87364	3·93682
5 =	·07716	77161·74370	11·02311	9·84206	4·92103
6 =	·09259	92594·09244	13·22773	11·81047	5·90524
7 =	·10803	108026·44118	15·43235	13·77888	6·88944
8 =	·12346	123458·78992	17·63697	15·74729	7·87365
9 =	·13889	138891·13866	19·84159	17·71570	8·85785

Troy Weight. / Apothecaries' Weight.

	Troy Weight. Grammes to Ounces Troy.	Troy Weight. Grammes to Penny-weights.	Apothecaries' Weight. Grammes to Scruples.
1 =	·03215	·64301	·77162
2 =	·06430	1·28603	1·54323
3 =	·09645	1·92904	2·31485
4 =	·12860	2·57206	3·08647
5 =	·16075	3·21507	3·85809
6 =	·19290	3·85809	4·62970
7 =	·22506	4·50110	5·40131
8 =	·25721	5·14412	6·17294
9 =	·28936	5·78713	6·94455

LEGAL STANDARD WIRE GAUGE AND METRIC EQUIVALENTS.

Numbers S.W.G.	Equivalents.		Numbers S.W.G.	Equivalents.	
	Inch.	Millimetres.		Inch.	Millimetres.
7/0	·500	12·700	23	·024	·610
6/0	·464	11·785	24	·022	·559
5/0	·432	10·973	25	·020	·508
4/0	·400	10·160	26	·018	·457
3/0	·372	9·449	27	·0164	·4166
2/0	·348	8·839	28	·0148	·3759
0	·324	8·229	29	·0136	·3454
1	·300	7·620	30	·0124	·3150
2	·276	7·010	31	·0116	·2946
3	·252	6·401	32	·0108	·2743
4	·232	5·893	33	·0100	·2540
5	·212	5·385	34	·0092	·2337
6	·192	4·877	35	·0084	·2134
7	·176	4·470	36	·0076	·1930
8	·160	4·064	37	·0068	·1727
9	·144	3·658	38	·0060	·1524
10	·128	3·251	39	·0052	·1321
11	·116	2·946	40	·0048	·1219
12	·104	2·642	41	·0044	·1118
13	·092	2·337	42	·0040	·1016
14	·080	2·032	43	·0036	·0914
15	·072	1·829	44	·0032	·0813
16	·064	1·626	45	·0028	·0711
17	·056	1·422	46	·0024	·0610
18	·048	1·219	47	·0020	·0508
19	·040	1·016	48	·0016	·0406
20	·036	·914	49	·0012	·0305
21	·032	·813	50	·0010	·0254
22	·028	·711	...	...	...

VOLUME OF WATER AT DIFFERENT TEMPERATURES.

For *ordinary* practical purposes, the following formulæ will enable the volume of water at different temperatures to be approximately ascertained ; the formulæ give the increase of a given volume of fresh water, from the temperature of maximum density, viz., 39·2 degrees Fahrenheit, 4 degrees Centigrade, and 3·2 degrees Réaumur, if the given volume be multiplied by the formula appropriate, viz., either Fahrenheit, Centigrade, or Réaumur.

Let T = Temperature in all cases.

$$1+\frac{(T-39{\cdot}2)^2}{711(679+T)} \quad \text{for Fahrenheit scale.}$$

$$1+\frac{(T-4)^2}{395(395+T)} \quad \text{for Centigrade scale.}$$

$$1+\frac{(T-3{\cdot}2)^2}{316(316+T)} \quad \text{for Réaumur scale.}$$

If the volume is increased by difference of temperature, the weight of a given measure will be decreased.

When the volume is diminished, due to temperature, the weight of a given measure is increased.

The weight of a given measure is inversely as the volume at the different temperatures.

Temperatures.

The thermometers generally used are Fahrenheit, Centigrade, and Réaumur. The Fahrenheit scale is generally used in Great Britain.

32 degrees Fahrenheit is usually termed the freezing point, and 212 degrees Fahrenheit the boiling point of fresh water ; 0 degrees Centigrade the freezing point, and 100 degrees Centigrade the boiling point ; 0 degrees Réaumur the freezing point, and 80 degrees Réaumur the boiling point.

The boiling point at those temperatures is when the barometer is at 30 inches. The boiling point is *about* one and a half degrees Fahr. higher when the barometer stands at 31 inches, and *about* one and a half degrees Fahr. lower when the Barometer is at 29 inches, and *about* 208·7 degrees when the barometer is at 28 inches.

The equivalent degrees of temperature on Fahrenheit, Centigrade, and Réaumur scales may be found as follows :—

Let T_F = Temperature, Fahrenheit.
T_C = „ Centigrade.
T_R = „ Réaumur.

Then

$$\tfrac{5}{9}(T_F - 32) = T_C$$
$$\tfrac{4}{9}(T_F - 32) = T_R$$
$$(\tfrac{9}{5}T_C) + 32 = T_F$$
$$\tfrac{4}{5}T_C = T_R$$
$$(\tfrac{9}{4}T_R) + 32 = T_F$$
$$\tfrac{5}{4}T_R = T_C$$

Water, Pure and Sea.

Their Composition, Temperatures at which they boil, Specific Gravities, &c.

Composition of Pure Water.

One part Hydrogen, and eight of Oxygen by weight.
Two parts Hydrogen, and one of Oxygen by volume.

When the Barometer is at 30 inches.
Pure water, boiling point, 212 degrees Fahr.
Pure water, freezing point, 32 degrees Fahr.
Pure water, greatest density at 39·2 degrees Fahr.

Composition of Sea Water.

Sea water varies in its component parts, but the principal ingredients in mid-ocean water are about as follows, in 1000 parts by weight:—

Water,	962·0
Chloride of sodium,	27·1
Chloride of magnesium,	5·4
Sulphate of magnesia,	1·2
Sulphate of lime,	0·8
Chloride of potassium,	0·4
Carbonate of lime,	0·1
Bromide of magnesia,	0·1
	997·1
Various ingredients,	2·9
	1000

The 2·9 parts consist of various ingredients and in different proportions, depending on a variety of circumstances, locality, &c., where the

water is obtained, such as sulphuretted hydrogen gas, hydrochlorate of ammonia, &c.

Sea water, greatest density at about 25·5 degrees Fahr.
Sea water, freezing point at about 27·2 degrees Fahr.
Sea water, saturated solution (brine).
Freezing point, about 4 degrees Fahr.

Generally, for practical purposes, sea water may be considered to contain $1/32$ part of salt, and as the proportion of salt increases, the temperature necessary to raise it to the boiling point also increases.

When the barometer is at 30 inches, ordinary sea water boils at 213·2 degrees Fahr.

The following table shows the different boiling points of ordinary sea water according to the quantity of salt in the water, also the specific gravities as compared with pure water, which is considered as 1.

Sea Water.

Boiling Points, Specific Gravities, &c.

Proportion of Salt in the Water.	Temperature, Fahrenheit, at which it Boils.	Specific Gravity.
$1/32$	213·2°	1·029
$2/32$	214·4°	1·058
$3/32$	215·5°	1·087
$4/32$	216·7°	1·116
$5/32$	217·9°	1·145
$6/32$	219·1°	1·174
$7/32$	220·3°	1·203
$8/32$	221·5°	1·232
$9/32$	222·7°	1·261
$10/32$	223·8°	1·290
$11/32$	225·0°	1·319
$12/32$	226·1°	1·348

When the water contains $12/32$ parts of salt, and does not boil until the temperature is 226·1 degrees Fahr., it is then considered to be a saturated solution, as the water will not hold any more salt in solution.

Although it has been stated that generally for *practical* purposes sea water may be considered to contain $1/32$ part of salt by weight, it has been found to contain, in places, considerably more, and even near our own shores a larger proportion has been found. It is, therefore, advisable to be on the watch in different parts of the ocean, so as not to be deceived by assuming that sea water is always of equal density or saltness, and has only $1/32$ part of salt in it.

When sea water is used in boilers, it is not advisable to let the proportion of salt in the water in the boiler exceed $3/32$, or the temperature at which it boils exceed 215·5 degrees Fahr. when the barometer is at 30 inches. Keeping the water at such a density necessitates blowing off $1/3$ of the water put into the boiler, if it be fed with sea water.

TABLE No. 204.

WEIGHT AND SPECIFIC GRAVITY OF METALS.

	Specific Gravity.	1 Cubic Foot.	1 Cubic Inch.	1 Square Foot 1 Inch Thick.	1 Square Foot $\frac{1}{8}$ Inch Thick.	1 Square Foot $\frac{1}{16}$ Inch Thick.	1 Square Foot $\frac{1}{32}$ Inch Thick.	1 Square Foot $\frac{1}{64}$ Inch Thick.	1 Square Foot $\frac{1}{100}$ Inch Thick.	Cubic Ins. to One Pound.
		lbs.	lb.	lbs.	lbs.	lbs.	lbs.	lb.	lb.	Cubic ins.
Mercury, . . .	13·560	845	·4890	70·416	8·802	4·401	2·200	1·100	·704	2·044
Lead, ...	11·392	710	·4108	59·166	7·395	3·697	1·848	·924	·591	2·433
Copper, *sheet*, . .	8·825	550	·3182	45·833	5·729	2·864	1·432	·716	·458	3·141
,, *cast*, . .	8·665	540	·3125	45·000	5·625	2·812	1·406	·703	·450	3·200
Brass, *sheet*, . .	8·504	530	·3067	44·166	5·520	2·760	1·380	·690	·441	3·260
,, *cast*, . .	8·023	500	·2893	41·666	5·208	2·604	1·302	·651	·416	3·456
Steel, *soft or mild*, .	7·862	490	·2835	40·833	5·104	2·552	1·276	·638	·408	3·526
,, *hard*, . .	7·814	487	·2818	40·583	5·072	2·536	1·268	·634	·405	3·548
Iron, *wrought*, . .	7·702	480	.2777	40·000	5·000	2·500	1·250	·625	·400	3·600
,, *cast*, . .	7·124	444	·2569	37·000	4·625	2·312	1·156	·578	·370	3·891
Tin, *cast*, . .	7·301	455	·2633	37·916	4·739	2·369	1·184	·592	·379	3·797
Zinc, *cast*, . .	6·900	430	·2488	35·833	4·479	2·239	1·119	·559	·358	4·018

The cross sectional area in square inches of a bar or angle, &c., multiplied by the length in inches of the bar or angle, &c., equals the number of cubic inches which it contains; therefore, the number of cubic inches in an article, multiplied by the weight of one cubic inch of the material of which the article is composed, equals the weight in lbs.

SAFETY VALVES.

There should be at least two safety valves fitted to each boiler, the combined area of which should not be less than that found by the table further on, but the smallest size which should be used is 2 inches in diameter.

Safety valves should always be fitted with screw lifting gear, and arranged so that two or more valves on any one boiler can at all times be eased together, without interfering with the valves on any other boiler. The lifting-gear should in all cases be arranged so that it can be worked by hand from the engine room or stoke hole, and it should be capable of lifting the valves when steam is *not* up. Unless the lift and means for escape of the waste steam be sufficient, the effect is the same as reducing the area of the valve, or extra loading it.

All safety valves should have a lift equal at least to one-fourth their diameter.

The openings for the passage of steam to and from the valves, including the waste steam pipe, should have an area not less than the area of the valve as found by the table further on.

Each safety valve box should have a drain pipe fitted at its lowest part.

When spring safety valves are fitted, the springs and valves should always be so arranged that the valve cannot come out, if the spring should break.

Safety valves should be cased in, so that the boiler attendant cannot in any way increase the load on the valves.

The springs for safety valves should, as far as practicable, be protected from the steam and impurities issuing from the boiler.

When safety valves are loaded by direct springs, the compressing screws should abut against metal stops or washers, when the loads settled and approved of by the Engineer Inspector are on the valves.

When valves are loaded by dead-weights, care should be taken that they are so fitted that they will not prevent the free escape of the steam.

Safety valves and their seats should be made of brass, and the seats should be secured by brass studs and brass nuts ; the minimum number of the studs and nuts should be three.

The weight necessary to load an ordinary dead-weighted safety valve may be found by multiplying the area of the valve by the working pressure per square inch, and subtracting the weight of the valve and spindle.

Each weight should represent a given number of lbs. pressure, say 5 lbs., as it is undesirable to have any one weight very heavy or cumbersome ; the weights should have the corners rounded, the holes in the centre of the weights should be easy fits for the spindle, and the edges of the holes should also be rounded off ; the skin of the casting should not be broken ; the weight of each, and also its equi-

valent in lbs. pressure per square inch, should be stamped on it. Means should be provided for lifting each weight separately.

If the safety valve lever be not bushed with brass, the pins should be of brass ; iron and iron working together should not be approved of.

The weight required to be placed on the end of the safety valve lever, so that there may be a given working pressure per square inch on the valve, may be found by multiplying the area of the valve by the working pressure, and subtracting from the product the effective weight of the lever and valve, and dividing the remainder by the leverage, which is the total length of lever from the fulcrum to the point where the weight is suspended, divided by the distance from the centre of the valve to the fulcrum in a line parallel to the face of the valve.

If the area of the valve be 10 square inches, and the working pressure 40 lbs. per square inch, the effective weight of lever and valve 20 lbs., the total length of lever 30 inches, and the distance between the centre of the valve and the fulcrum 3 inches, the weight on the end of the lever is 38 lbs.,

$$(10 \times 40) - 20 = 380$$

$$30 \div 3 = 10$$

$$380 \div 10 = 38 \text{ lbs.},$$

which is the weight required to be placed on the end of the lever to load the valve to 40 lbs. per square inch.

When the weight of the valve is 2 lbs., the weight of the lever 4 lbs., the distance between the fulcrum and the centre of gravity of the lever 13·5 inches, and the distance between the fulcrum and centre of valve 3 inches, the effective weight of the lever and valve is 20 lbs.,

$$13{\cdot}5 \div 3 = 4{\cdot}5$$

$$(4{\cdot}5 \times 4) + 2 = 20 \text{ lbs.},$$

which is the effective weight of lever and valve. Therefore, if the distance between the fulcrum and centre of gravity of lever be divided by the distance between the fulcrum and centre of valve, and then multiplied by the weight of lever, and the weight of the valve added to the product, the effective weight of lever and valve is found.

In any case in which a spring balance is used to load a lever safety valve, the leverage should be equal to the number of square inches area of the valve ; that is, if the area of the valve be 10 square inches, the leverage should be 10, or the total length of lever should be 10 times the distance between the centre of valve and fulcrum. When the leverage and balance are not so arranged, errors frequently take place, and have caused explosions.

TESTING AND ADJUSTING SAFETY VALVES, &c.

All safety valves should be tested for accumulation, when under full steam and hard firing, for at least twenty minutes, with the feeds shut off and stop valves closed; the accumulation of pressure should not exceed 10 per cent. of the loaded pressure. It should not be overlooked that, with the nominal factor of 5, the factor is reduced to *about* 4·5 when the accumulation is 10 per cent.

If safety valves, particularly spring and lever valves, be not properly tried, to see that there is no undue amount of accumulation of pressure, accidents will surely follow. Valves should be particularly well fitted, but should not be too tight, otherwise when steam is up, more particularly after the water has been priming, the valves are very apt to stick, and an undue accumulation of pressure takes place.

When the Engineer Inspector has settled the working pressure, he should see the valves loaded to that pressure, and the weights or springs fixed in such a manner as to prevent the possibility of their shifting, so as to, in any way, increase the load on the safety valves.

Although different methods of loading safety valves have been remarked on, direct spring loaded valves, when properly constructed, are those which are recommended for marine boilers; if land boilers were always in charge of skilled men, spring loaded valves might also be recommended for them. Very many land boilers are looked after by men who should not be trusted to adjust spring safety valves. Valves loaded by direct weights are those which are most likely to act as real safety valves, when in the hands of the ordinary attendants of land boilers. Although it may not in every case be necessary to have all the valves on such boilers loaded by direct weights, it is desirable that one of them be so fitted, and the others, in some cases if desired, may be loaded by lever and weights, but spring lever loaded valves alone are very undesirable; such a method presents a ready way of overloading, and many explosions of boilers have taken place, due to the extra loading of lever valves. If the load be applied by a spring balance, there should be a stop on the screw to prevent the pressure being increased by merely turning the nut; but, even then, the pressure can be easily increased by reckless or ignorant persons, and even accidentally this has occurred; therefore, it is very undesirable that lever valves should be the only description fitted on any boiler, more particularly if not properly cased in. So far as the valve is concerned, the common flat face or mitre seat keeps longer in order than a lip or lifter one, and gives much less trouble when steam is blowing off freely.

The areas of safety valves as found by the table which follows, No. 205, are minimum areas, and it is desirable that they should be exceeded, for, if not, when the pressure is reduced, due to the age of

the boiler, &c., the accumulation will exceed that which it is prudent to allow.

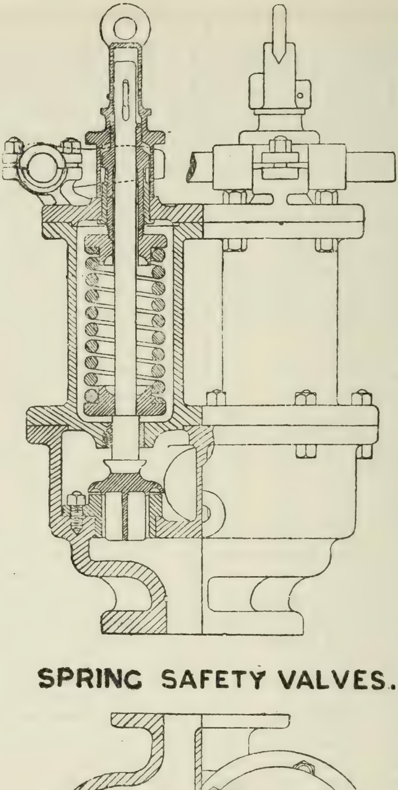
When forced draught is used, it is essential that the areas of safety valves should be considerably in excess of those arrived at by the use of the table, otherwise the accumulation will be too great. The amount of increase will depend upon the circumstances of each case; but in no case is less than 25 per cent. increase recommended, and it has been found that, even when the area was double that required by the table, there was more accumulation than was desirable. It is expedient to arrange so that the forced draught can be stopped from the starting platform, more particularly when the draught does not cease when the engine stops.

Although forced draught has been found to be injurious to boilers and to shorten their life, yet it may be desirable to adopt it in some cases, but when practicable it is well that boilers be constructed and proportioned so as to do the work required of them without forced draught.

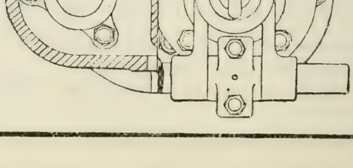
Boiler Pressure per Square Inch.	Area of Valve per Square Foot of Fire Grate.	Boiler Pressure per Square Inch.	Area of Valve per Square Foot of Fire Grate.	Boiler Pressure per Square Inch.	Area of Valve per Square Foot of Fire Grate.	Boiler Pressure per Square Inch.	Area of Valve per Square Foot of Fire Grate.	Boiler Pressure per Square Inch.	Area of Valve per Square Foot of Fire Grate.	Boiler Pressure per Square Inch.	Area of Valve per Square Foot of Fire Grate.
lbs.	sq. ins.	lbs.	sq. in.	lbs.	sq. in.	lbs.	sq. in.	lbs.	sq. in.	lbs.	sq. in.
5	2·206	38	·707	71	·436	104	·315	137	·246	170	·202
6	1·935	39	·694	72	·431	105	·312	138	·245	171	·201
7	1·763	40	·681	73	·426	106	·309	139	·243	172	·200
8	1·655	41	·669	74	·421	107	·307	140	·241	173	·199
9	1·571	42	·657	75	·416	108	·304	141	·240	174	·198
10	1·502	43	·646	76	·412	109	·302	142	·238	175	·197
11	1·442	44	·635	77	·407	110	·300	143	·237	176	·196
12	1·388	45	·625	78	·403	111	·297	144	·235	177	·195
13	1·339	46	·614	79	·398	112	·295	145	·234	178	·194
14	1·293	47	·604	80	·394	113	·292	146	·232	179	·193
15	1·250	48	·595	81	·390	114	·290	147	·231	180	·192
16	1·209	49	·585	82	·386	115	·288	148	·230	181	·191
17	1·171	50	·576	83	·382	116	·286	149	·228	182	·190
18	1·136	51	·568	84	·378	117	·284	150	·227	183	·189
19	1·102	52	·559	85	·375	118	·281	151	·225	184	·188
20	1·071	53	·551	86	·371	119	·279	152	·224	185	·187
21	1·041	54	·543	87	·367	120	·277	153	·223	186	·186
22	1·013	55	·535	88	·364	121	·275	154	·221	187	·185
23	·986	56	·528	89	·360	122	·273	155	220	188	·184
24	·961	57	·520	90	·357	123	·271	156	·219	189	·183
25	·937	58	·513	91	·353	124	·269	157	·218	190	·182
26	·914	59	·506	92	·350	125	·267	158	·216	191	181
27	·892	60	·500	93	·347	126	·265	159	·215	192	·181
28	·872	61	·493	94	·344	127	·264	160	·214	193	·180
29	·852	62	·487	95	·340	128	·262	161	·213	194	·179
30	·833	63	·480	96	·337	129	·260	162	·211	195	·178
31	·815	64	·474	97	·334	130	·258	163	·210	196	·177
32	·797	65	·468	98	·331	131	·256	164	·209	197	·176
33	·781	66	·462	99	·328	132	·255	165	·208	198	·176
34	·765	67	·457	100	·326	133	·253	166	·207	199	·175
35	·750	68	·451	101	323	134	·251	167	·206	200	·174
36	·735	69	·446	102	·320	135	·250	168	·204	201	·173
37	·721	70	·441	103	·317	136	·248	169	·203	202	·172

The above Table gives the minimum areas.

Each boiler should have at least two valves, each not less than 2 inches in diameter.



SPRING SAFETY VALVES.



SPRING SAFETY VALVES.

In the Tables, Nos. 206 to 215, which follow these notes, the dimensions of the different parts of safety valves loaded by spiral springs will be found.

The valves, seats, spindles, compressing screws and their nuts, spring washers, bushes in bottom of spring case, cotters in top of spindle and cap, studs and nuts for securing the seats, and the bushes or bearings for easing gear shaft, should be made of a good quality of brass or gun metal.

The chests, spring cases, and caps may be made of cast iron.

The easing gear shaft should be made of wrought iron or steel; wrought iron shafts are recommended, with the lifting forks forged out of the solid.

The bolts or studs for the flanges and easing gear should be made of wrought iron.

The top of hoods may be made either as shown in the drawing, page 402, or with cross handles, or with hexagon heads, as shown on page 524.

Valves are generally made with a lip, as shown in the drawing, page 402, but valves without lips are less violent in their action.

There should not be a less number of ribs to the neck of the valve chests than four, as shown in the drawing, but it may be desirable to have more than four in the large sizes.

In Table No. 211 the diameter given for flanges of waste steam-pipe may be adopted for all pressures.

The cap of the spring case should be made the same thickness as the top flange of the case.

The point of the compressing screw should be well rounded, and made to enter the recess in the top washer for the spring. The length of the point should be from about ⅜ inch in the small sizes to about ¾ inch in the large sizes, the length of the point is in addition to the screwed part which enters the cap.

In the drawing, springs made of round steel are shown, but in the Tables the sizes of springs both of round and square steel, are given.

Particulars and drawings of gun metal safety valves of 2 inches diameter will be found further on. See pages 524 to 529.

SPRING SAFETY VALVES.

TABLE No. 206.

Diameter of Valves.	Diameter of Inlet.	Diameter of Outlet.	Dimensions of Chest below Valves, inside.			Dimensions of Chest above Valves, inside.		Height of Chest.	Diameter of Bottom Flange of Chest.
			Height.	Length.	Width.	Length.	Width.	Total.	
inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
2	2 7/8	3	4	9 1/2	3	11 3/4	5 1/4	8 3/4	8 1/2
2 1/4	3 3/16	3 5/16	4 1/4	10 5/16	3 5/16	12 11/16	5 11/16	9 3/8	9
2 1/2	3 9/16	3 11/16	4 1/2	11 1/8	3 5/8	13 5/8	6 1/8	10	9 1/2
2 3/4	3 15/16	4 1/16	4 3/4	11 15/16	3 15/16	14 9/16	6 9/16	10 5/8	10
3	4 1/4	4 7/16	5	12 3/4	4 1/4	15 1/2	7	11 1/4	10 1/2
3 1/4	4 5/8	4 13/16	5 1/4	13 9/16	4 9/16	16 7/16	7 7/16	11 7/8	11
3 1/2	5	5 3/16	5 1/2	14 3/8	4 7/8	17 3/8	7 7/8	12 1/2	11 1/2
3 3/4	5 5/16	5 1/2	5 3/4	15 3/16	5 3/16	18 5/16	8 5/16	13 1/8	12
4	5 11/16	5 15/16	6	16	5 1/2	19 1/4	8 3/4	13 3/4	12 1/2
4 1/4	6	6 1/4	6 1/4	16 13/16	5 13/16	20 3/16	9 3/16	14 3/8	13
4 1/2	6 3/8	6 5/8	6 1/2	17 5/8	6 1/8	21 1/8	9 5/8	15	13 1/2
4 3/4	6 3/4	7	6 3/4	18 7/16	6 7/16	22 1/16	10 1/16	15 5/8	14
5	7 1/16	7 3/8	7	19 1/4	6 3/4	23	10 1/2	16 1/4	14 1/2
5 1/4	7 7/16	7 3/4	7 1/4	20 1/16	7 1/16	23 15/16	10 15/16	16 7/8	15
5 1/2	7 3/4	8 1/16	7 1/2	20 7/8	7 3/8	24 7/8	11 3/8	17 1/2	15 1/2
5 3/4	8 1/8	8 7/16	7 3/4	21 11/16	7 11/16	25 13/16	11 13/16	18 1/8	16
6	8 1/2	8 7/8	8	22 1/2	8	26 3/4	12 1/4	18 3/4	16 1/2

SPRING SAFETY VALVES.

TABLE No. 207.

Diameter of Valves.	Top Flange of Valve Chest.		Bolts for Bottom Flange of Chest.		Brass Studs for securing Valve Seats.		Drain Pipe, Diameter.	Spring Case.	
	Thickness.	Diameter.	Number.	Diameter.	Number.	Diameter.		Height, Total.	Bottom Flange, Diameter.
inches.	inch.	inches.		inch.		inch.	inch.	inches.	inches.
2	13/16	8¼	6	⅝	3	½	¾	8 ½	8¼
2¼	⅞	8¾	6	⅝	3	½	¾	9 9/16	8¾
2½	⅞	9¼	6	⅝	3	½	¾	10 ⅝	9¼
2¾	⅞	9¾	6	⅝	3	½	¾	11 11/16	9¾
3	15/16	10¼	6	¾	3	½	¾	12 ¾	10¼
3¼	15/16	10¾	6	¾	3	⅝	¾	13 13/16	10¾
3½	15/16	11¼	6	¾	3	⅝	¾	14 ⅞	11¼
3¾	1	11¾	6	¾	3	⅝	¾	15 15/16	11¾
4	1	12¼	8	¾	4	⅝	⅞	17	12¼
4¼	1	12¾	8	¾	4	⅝	⅞	18 1/16	12¾
4½	1 1/16	13¼	8	¾	4	⅝	⅞	19 ⅛	13¼
4¾	1 1/16	13¾	8	¾	4	⅝	⅞	20 3/16	13¾
5	1 1/16	14¼	8	⅞	4	¾	1	21 ¼	14¼
5¼	1 ⅛	14¾	8	⅞	4	¾	1	22 5/16	14¾
5½	1 ⅛	15¼	8	⅞	4	¾	1	23 ⅜	15¼
5¾	1 ⅛	15¾	8	⅞	4	¾	1	24 7/16	15¾
6	1 ⅛	16¼	8	⅞	4	¾	1	25 ½	16¼

SPRING SAFETY VALVES.

TABLE No. 208.

Diameter of Valves.	Bolts and Studs connecting Spring Case to Valve Chest.		Bolts connecting Cap to Spring Case.		Length of Lifting Lever.	Length of Guide of Hood.	Lift of Valve and Clearance at Top of Spindle.	Distance between Centres of Valves.
	Number.	Diameter.	Number.	Diameter.				
inches.		inch.		inch.	inches.	inches.	inch.	inches.
2	6	½	4	½	3 ½	1	½	6½
2¼	6	½	4	½	3 9/16	1 1/16	9/16	7
2½	6	½	4	½	3 ⅝	1 ⅛	⅝	7½
2¾	6	½	4	½	3 11/16	1 3/16	11/16	8
3	6	½	4	½	3 ¾	1 ¼	¾	8½
3¼	6	½	4	½	3 13/16	1 5/16	13/16	9
3½	6	½	4	½	3 ⅞	1 ⅜	⅞	9½
3¾	6	⅝	4	⅝	3 15/16	1 7/16	15/16	10
4	6	⅝	4	⅝	4	1 ½	1	10½
4¼	6	⅝	4	⅝	4 1/16	1 9/16	1 1/16	11
4½	6	⅝	4	⅝	4 ⅛	1 ⅝	1 ⅛	11½
4¾	6	⅝	4	⅝	4 3/16	1 11/16	1 3/16	12
5	6	¾	4	¾	4 ¼	1 ¾	1 ¼	12½
5¼	6	¾	4	¾	4 5/16	1 13/16	1 5/16	13
5½	6	¾	4	¾	4 ⅜	1 ⅞	1 ⅜	13½
5¾	6	¾	4	¾	4 7/16	1 15/16	1 7/16	14
6	6	¾	4	¾	4 ½	2	1 ½	14½

SPRING SAFETY VALVES.

TABLE NO. 209.

Diameter of Spindles.		Dimensions of Cotters.		Compressing Screw.		
Body.	Lower Part.	Breadth.	Thickness.	Diameter.	Length under Head.	Depth of Nut.
inch.	inches.	inches.	inch.	inches.	inches.	inches.
3/4	7/8	15/16	3/16	1 1/4	2 9/16	1 9/16
13/16	15/16	1	7/32	1 1/4	2 5/8	1 5/8
7/8	1 1/16	1 1/16	7/32	1 3/8	2 11/16	1 11/16
15/16	1 1/8	1 1/8	1/4	1 1/2	2 3/4	1 3/4
1	1 1/4	1 1/4	1/4	1 5/8	2 13/16	1 13/16
1 1/16	1 5/16	1 3/8	1/4	1 3/4	2 7/8	1 7/8
1 1/8	1 7/16	1 3/8	9/32	1 3/4	2 15/16	1 15/16
1 3/16	1 9/16	1 1/2	9/32	1 7/8	3	2
1 1/4	1 5/8	1 9/16	5/16	2	3 1/16	2 1/16
1 5/16	1 3/4	1 5/8	5/16	2 1/8	3 1/8	2 1/8
1 3/8	1 13/16	1 3/4	11/32	2 1/8	3 3/16	2 3/16
1 7/16	1 7/8	1 3/4	3/8	2 1/4	3 1/4	2 1/4
1 1/2	2	1 7/8	3/8	2 3/8	3 5/16	2 5/16
1 9/16	2 1/16	2	3/8	2 3/8	3 3/8	2 3/8
1 5/8	2 1/8	2	13/32	2 1/2	3 7/16	2 7/16
1 11/16	2 1/4	2 1/8	13/32	2 5/8	3 1/2	2 1/2
1 3/4	2 3/8	2 3/8	7/16	2 3/4	3 9/16	2 9/16

SPRING SAFETY VALVES.

Springs.		Working Load for Springs.		Spring Case.				Washers for Springs, Thickness of Flanges.
Diameter or Side of Steel.	Mean Diameter of Coils.	Round Steel.	Square Steel.	Diameter Inside.	Thickness of Case.	Diameter of Top Flange.	Thickness of Top Flange.	
inch.	inches.	lbs.	lbs.	inches.	inch.	inches.	inch.	inch.
1/4	1 1/4	100	137	2	1/4	4 1/2	7/16	1/4
9/32	1 13/32	126	174	2 1/4	1/4	4 3/4	9/16	9/32
5/16	1 9/16	156	214	2 7/16	5/16	5	5/8	5/16
11/32	1 23/32	189	260	2 5/8	5/16	5 1/4	5/8	11/32
3/8	1 7/8	225	309	2 13/16	5/16	5 1/2	5/8	3/8
13/32	2 1/32	264	363	3 1/16	5/16	5 3/4	5/8	13/32
7/16	2 3/16	306	421	3 1/4	3/8	6	11/16	7/16
15/32	2 11/32	351	483	3 7/16	3/8	6 1/4	11/16	15/32
1/2	2 1/2	400	550	3 5/8	3/8	6 1/2	11/16	1/2
17/32	2 21/32	451	620	3 7/8	3/8	6 3/4	11/16	17/32
9/16	2 13/16	506	696	4 1/16	3/8	7	11/16	9/16
19/32	2 31/32	564	775	4 1/4	7/16	7 1/4	3/4	19/32
5/8	3 1/8	625	859	4 7/16	7/16	7 1/2	3/4	5/8
21/32	3 9/32	689	947	4 11/16	7/16	7 3/4	3/4	21/32
11/16	3 7/16	756	1039	4 7/8	7/16	8	3/4	11/16
23/32	3 19/32	826	1136	5 1/16	7/16	8 1/4	3/4	23/32
3/4	3 3/4	900	1237	5 1/4	7/16	8 1/2	3/4	3/4
25/32	3 29/32	976	1342	5 1/2	1/2	8 3/4	13/16	25/32
13/16	4 1/16	1056	1452	5 11/16	1/2	9	13/16	13/16
27/32	4 7/32	1139	1566	5 7/8	1/2	9 1/4	13/16	27/32
7/8	4 3/8	1225	1684	6 1/16	1/2	9 1/2	13/16	7/8
29/32	4 17/32	1314	1806	6 5/16	1/2	9 3/4	13/16	29/32
15/16	4 11/16	1406	1933	6 1/2	1/2	10	13/16	15/16
31/32	4 27/32	1501	2064	6 11/16	1/2	10 1/4	13/16	31/32
1	5	1600	2200	6 7/8	9/16	10 1/2	7/8	1
1 1/32	5 5/32	1701	2339	7 1/8	9/16	10 3/4	7/8	1 1/32
1 1/16	5 5/16	1806	2483	7 5/16	9/16	11	7/8	1 1/16
1 3/32	5 15/32	1914	2631	7 1/2	9/16	11 1/4	7/8	1 3/32
1 1/8	5 5/8	2025	2784	7 11/16	9/16	11 1/2	7/8	1 1/8
1 5/32	5 25/32	2139	2941	7 15/16	9/16	11 3/4	7/8	1 5/32
1 3/16	5 15/16	2256	3102	8 1/8	9/16	12	7/8	1 3/16
1 7/32	6 3/32	2376	3267	8 5/16	5/8	12 1/4	15/16	1 7/32
1 1/4	6 1/4	2500	3437	8 1/2	5/8	12 1/2	15/16	1 1/4

SPRING SAFETY VALVES.

TABLE No. 211.

The Dimensions in this Table are for Valves loaded to a Pressure not exceeding 40 Pounds per Square Inch.

Diameter of Valves.	Diameter of Body of Spindle.	Bottom Flange of Chest Thickness.	Flange on Chest for Waste Steam Pipe for all Pressures.		Thickness of Chest.		Easing Gear Shaft, Diameter.
			Diameter.	Thickness.	Below Valves.	Above Valves.	
inches.	inch.	inch.	inches.	inch.	inch.	inch.	inch.
2	3/4	3/4	7 1/2	1/2	1/2	3/8	7/8
2 1/4	13/16	13/16	7 15/16	9/16	9/16	3/8	7/8
2 1/2	7/8	13/16	8 3/8	9/16	9/16	3/8	15/16
2 3/4	15/16	13/16	8 13/16	5/8	9/16	7/16	1
3	1	13/16	9 1/4	5/8	9/16	7/16	1 1/16
3 1/4	1 1/16	7/8	9 11/16	11/16	5/8	7/16	1 1/8
3 1/2	1 1/8	7/8	10 1/8	11/16	5/8	7/16	1 3/16
3 3/4	1 3/16	7/8	10 9/16	3/4	5/8	7/16	1 1/4
4	1 1/4	7/8	11	3/4	5/8	7/16	1 5/16
4 1/4	1 5/16	15/16	11 7/16	13/16	11/16	7/16	1 3/8
4 1/2	1 3/8	15/16	11 7/8	13/16	11/16	7/16	1 7/16
4 3/4	1 7/16	15/16	12 5/16	7/8	11/16	1/2	1 1/2
5	1 1/2	15/16	12 3/4	7/8	11/16	1/2	1 9/16
5 1/4	1 9/16	1	13 3/16	15/16	3/4	1/2	1 5/8
5 1/2	1 5/8	1	13 5/8	15/16	3/4	1/2	1 11/16
5 3/4	1 11/16	1	14 1/16	1	3/4	1/2	1 3/4
6	1 3/4	1	14 1/2	1	3/4	1/2	1 13/16

SPRING SAFETY VALVES.

TABLE No. 212.

The Dimensions in this Table are for Valves loaded to a Pressure not exceeding 80 Pounds per Square Inch.

Diameter of Valves.	Diameter of Body of Spindles.	Bottom Flange of Chest, Thickness.	Thickness of Chest.		Easing Gear Shaft, Diameter.
			Below Valves.	Above Valves.	
inches.	inch.	inch.	inch.	inch.	inches.
2	13/16	13/16	9/16	7/16	1
2 1/4	7/8	7/8	5/8	7/16	1 1/16
2 1/2	15/16	7/8	5/8	7/16	1 3/16
2 3/4	1	7/8	5/8	7/16	1 1/4
3	1 1/16	15/16	11/16	7/16	1 3/8
3 1/4	1 1/8	15/16	11/16	1/2	1 7/16
3 1/2	1 3/16	15/16	11/16	1/2	1 1/2
3 3/4	1 1/4	1	3/4	1/2	1 9/16
4	1 5/16	1	3/4	1/2	1 11/16
4 1/4	1 3/8	1	3/4	1/2	1 3/4
4 1/2	1 7/16	1 1/16	13/16	1/2	1 13/16
4 3/4	1 1/2	1 1/16	13/16	9/16	1 7/8
5	1 9/16	1 1/16	13/16	9/16	1 15/16
5 1/4	1 5/8	1 1/8	7/8	9/16	2 1/16
5 1/2	1 11/16	1 1/8	7/8	9/16	2 1/8
5 3/4	1 3/4	1 1/8	7/8	9/16	2 3/16

SPRING SAFETY VALVES.

TABLE No. 213.

The Dimensions in this Table are for Valves loaded to a Pressure not exceeding 120 Pounds per Square Inch.

Diameter of Valves.	Diameter of Body of Spindles.	Bottom Flange of Chest, Thickness.	Thickness of Chest.		Easing Gear Shaft, Diameter.
			Below Valves.	Above Valves.	
inches.	inch.	inch.	inch.	inch.	inches.
2	7/8	7/8	5/8	7/16	1 3/16
2 1/4	15/16	15/16	11/16	7/16	1 1/4
2 1/2	1	15/16	11/16	1/2	1 3/8
2 3/4	1 1/16	1	3/4	1/2	1 7/16
3	1 1/8	1	3/4	1/2	1 9/16
3 1/4	1 3/16	1	3/4	1/2	1 5/8
3 1/2	1 1/4	1 1/16	13/16	1/2	1 3/4
3 3/4	1 5/16	1 1/16	13/16	9/16	1 13/16
4	1 3/8	1 1/16	13/16	9/16	1 7/8
4 1/4	1 7/16	1 1/8	7/8	9/16	2
4 1/2	1 1/2	1 1/8	7/8	9/16	2 1/16
4 3/4	1 9/16	1 3/16	15/16	9/16	2 3/16
5	1 5/8	1 3/16	15/16	5/8	2 1/4
5 1/4	1 11/16	1 3/16	15/16	5/8	2 5/16
5 1/2	1 3/4	1 1/4	1	5/8	2 3/8

SPRING SAFETY VALVES.

TABLE No. 214.

The Dimensions in this Table are for Valves loaded to a Pressure not exceeding 160 Pounds per Square Inch.

Diameter of Valves.	Diameter of Body of Spindles.	Bottom Flange of Chest, Thickness.	Thickness of Chest.		Easing Gear Shaft, Diameter.
			Below Valves.	Above Valves.	
inches.	inch.	inch.	inch.	inch.	inches.
2	15/16	15/16	11/16	1/2	1 1/4
2 1/4	1	1	3/4	1/2	1 3/8
2 1/2	1 1/16	1	3/4	1/2	1 1/2
2 3/4	1 1/8	1 1/16	13/16	1/2	1 9/16
3	1 3/16	1 1/16	13/16	9/16	1 11/16
3 1/4	1 1/4	1 1/8	7/8	9/16	1 13/16
3 1/2	1 5/16	1 1/8	7/8	9/16	1 7/8
3 3/4	1 3/8	1 3/16	15/16	9/16	2
4	1 7/16	1 3/16	15/16	5/8	2 1/16
4 1/4	1 1/2	1 3/16	15/16	5/8	2 3/16
4 1/2	1 9/16	1 1/4	1	5/8	2 5/16
4 3/4	1 5/8	1 1/4	1	5/8	2 3/8
5	1 11/16	1 5/16	1 1/16	5/8	2 1/2
5 1/4	1 3/4	1 5/16	1 1/16	11/16	2 9/16

SPRING SAFETY VALVES.

TABLE No. 215.

The Dimensions in this Table are for Valves loaded to a Pressure not exceeding 200 Pounds per Square Inch.

Diameter of Valves.	Diameter of Body of Spindles.	Bottom Flange of Chest, Thickness.	Thickness of Chest.		Easing Gear Shaft, Diameter.
			Below Valves.	Above Valves.	
inches.	inch.	inch.	inch.	inch.	inches.
2	1	1	3/4	1/2	1 3/8
2 1/4	1 1/16	1 1/16	13/16	1/2	1 1/2
2 1/2	1 1/8	1 1/16	13/16	9/16	1 5/8
2 3/4	1 3/16	1 1/8	7/8	9/16	1 11/16
3	1 1/4	1 1/8	7/8	9/16	1 13/16
3 1/4	1 5/16	1 3/16	15/16	9/16	1 15/16
3 1/2	1 3/8	1 3/16	15/16	5/8	2 1/16
3 3/4	1 7/16	1 1/4	1	5/8	2 1/8
4	1 1/2	1 1/4	1	5/8	2 1/4
4 1/4	1 9/16	1 5/16	1 1/16	5/8	2 3/8
4 1/2	1 5/8	1 5/16	1 1/16	11/16	2 7/16
4 3/4	1 11/16	1 3/8	1 1/8	11/16	2 9/16
5	1 3/4	1 3/8	1 1/8	11/16	2 5/8

SPIRAL SPRINGS FOR SAFETY VALVES.

D = Diameter from centre to centre of wire, in inches, which is usually termed the mean diameter of the spring (without load).
d = Diameter of wire or side of square, in inches.
S = Load on spring, in lbs.
C = 11000, if spring is made of square steel
C = 8000, if spring is made of round steel.
K = Compression, in inches.
N = Number of coils in spring.

$$\sqrt[3]{\frac{S \times D}{C}} = d$$

$$\frac{d^3 \times C}{S} = D.$$

$$\frac{C \times d^3}{D} = S.$$

If the ratio $\frac{D}{d}$ be *constant*, the safe working load varies as the square of the side, or diameter, of the steel of which springs are made; but when D is constant—that is, the same for all sizes of steel—the safe working load varies as the cube of the side, or diameter, of the steel. If r is the ratio which is considered desirable, then :—

$$r \times d = D.$$

$$\frac{S \times r \times d}{C} = d^3.$$

$$\sqrt{\frac{S \times r}{C}} = d.$$

A convenient value for the ratio r is 5, and the loads given in Table No. 210 are for springs of this ratio. This makes a well-proportioned spring, and it is recommended that springs be so made unless there are good reasons to the contrary. When such is the case, the size of steel is found as follows:—

$$\left.\begin{aligned} \sqrt{\frac{S}{1600}} &= d \\ 1600d^2 &= S \end{aligned}\right\} \text{for round steel.}$$

$$\left.\begin{aligned} \sqrt{\frac{S}{2200}} &= d \\ 2200d^2 &= S \end{aligned}\right\} \text{for square steel.}$$

Springs of less strength should not be used for safety valves, as permanent set takes place at from 3·25 to 3·5 times the load found by the formulæ.

The compression due to the load, or the number of coils required for a given compression, can be found approximately by what follows. The compression varies slightly, owing to differences in the hardness, &c., of the steel; but the formulæ will be found sufficiently accurate for practical purposes.

$$\frac{S \times D^3 \times N}{1400000 \times d^4} = K \text{ (Springs made of round steel).}$$

$$\frac{S \times D^3 \times N}{2000000 \times d^4} = K \text{ (Springs made of square steel.}$$

Or, if d be taken in $^1\!/_{16}$ths, instead of in inches

$$\left.\begin{aligned} \frac{S \times D^3 \times N}{22 \times d^4} &= K \\ \frac{K \times 22 \times d^4}{S \times D^3} &= N \end{aligned}\right\} \text{Springs made of round steel.}$$

$$\left.\begin{aligned} \frac{S \times D^3 \times N}{30 \times d^4} &= K \\ \frac{K \times 30 \times d^4}{S \times D^3} &= N \end{aligned}\right\} \text{Springs made of square steel.}$$

The compression of springs of safety valves, due to the working load, should not be less than one-fourth the diameter of the valve, and it is desirable that it should be more. It is better for boilers to have common valves and springs with good elasticity, than lip valves with rigid springs, as the action of the latter is often very violent, and causes excessive vibration, which should be avoided if possible.

SPIRAL SPRINGS MADE OF STEEL.

Tested to ascertain Compression, &c., due to different Loads applied up to Twice the Working Load.

Shape of Steel.	Size of Steel.	Pitch of Coils	Mean Diameter of Coils.	Number of Complete Coils.	Original Length of Spring.	Length of Spring with working load on it.	Working Load.	Compression produced by working load.	Compression produced by twice the working load.	Average compression due to each 56 lbs. applied up to the working load.	Average compression due to each 56 lbs. applied after the load reached the working load up to twice the working load.
	in.	in.	ins.		ins.	ins.	lbs.	ins.	ins.	in.	ins.
Square	$\frac{1}{4}$	$\frac{7}{16}$	$1\frac{1}{4}$	7	$3\frac{1}{4}$	2·98	137	·27	·55	·110	·112
Square	$\frac{1}{2}$	$\frac{15}{16}$	$2\frac{1}{2}$	7	$6\frac{5}{16}$	5·85	550	·46	·92	·046	·046
Square	$\frac{3}{4}$	$1\frac{9}{32}$	$3\frac{3}{4}$	7	$9\frac{9}{16}$	8·84	1237	·72	1·44	·032	·032
Square	$\frac{3}{8}$	·648	$1\frac{7}{8}$	$13\frac{1}{2}$	$8\frac{3}{4}$	8·09	309	·66	1·33	·120	·120
Square	$\frac{7}{16}$	·759	$2\frac{3}{16}$	$13\frac{1}{2}$	$10\frac{1}{4}$	9·5	421	·75	1·51	·100	·100
Square	$\frac{1}{2}$	·870	$2\frac{1}{2}$	$13\frac{1}{2}$	$11\frac{3}{4}$	10·73	550	1·02	2·02	·103	·102
Square	$\frac{9}{16}$	·962	$2\frac{13}{16}$	$13\frac{1}{2}$	13	11·94	696	1·06	2·11	·085	·084
Square	$\frac{5}{8}$	1·074	$3\frac{1}{8}$	$13\frac{1}{2}$	$14\frac{1}{2}$	13·3	859	1·20	2·40	·078	·078
Square	$\frac{11}{16}$	1·185	$3\frac{7}{16}$	$13\frac{1}{2}$	16	14·65	1039	1·35	2·69	072	·072
Square	$\frac{3}{4}$	1·296	$3\frac{3}{4}$	$13\frac{1}{2}$	$17\frac{1}{2}$	16·14	1237	1·36	2·71	·061	·061
Square	$\frac{13}{16}$	1·407	$4\frac{1}{16}$	$13\frac{1}{2}$	19	17·56	1452	1·44	2·87	·055	·055
Square	$\frac{7}{8}$	1·509	$4\frac{3}{8}$	$13\frac{1}{2}$	$20\frac{3}{8}$	18·73	1684	1·64	3·29	·054	·054
Square	$\frac{15}{16}$	1·611	$4\frac{11}{16}$	$13\frac{1}{2}$	$21\frac{3}{4}$	19·99	1933	1·76	3·51	·050	·050
Square	1	1·722	5	$13\frac{1}{2}$	$23\frac{1}{4}$	21·42	2200	1·83	3·66	·046	·046
Round	$\frac{3}{8}$	·648	$1\frac{7}{8}$	$13\frac{1}{2}$	$8\frac{3}{4}$	8·11	225	·64	1·30	·160	·161
Round	$\frac{7}{16}$	·759	$2\frac{3}{16}$	$13\frac{1}{2}$	$10\frac{1}{4}$	9·53	306	·72	1·50	·131	·137
Round	$\frac{1}{2}$	·870	$2\frac{1}{2}$	$13\frac{1}{2}$	$11\frac{3}{4}$	10·83	400	·92	1·85	·128	·129
Round	$\frac{9}{16}$	·962	$2\frac{13}{16}$	$13\frac{1}{2}$	13	11·93	506	1·07	2·10	·118	·116
Round	$\frac{5}{8}$	1·074	$3\frac{1}{8}$	$13\frac{1}{2}$	$14\frac{1}{2}$	13·25	625	1·25	2·46	·112	·110
Round	$\frac{11}{16}$	1·185	$3\frac{7}{16}$	$13\frac{1}{2}$	16	14·78	756	1·22	2·44	·090	·090
Round	$\frac{3}{4}$	1·296	$3\frac{3}{4}$	$13\frac{1}{2}$	$17\frac{1}{2}$	16·18	900	1·32	2·61	·082	·081
Round	$\frac{13}{16}$	1·407	$4\frac{1}{16}$	$13\frac{1}{2}$	19	17·47	1056	1·53	2·99	·081	·079
Round	$\frac{7}{8}$	1·509	$4\frac{3}{8}$	$13\frac{1}{2}$	$20\frac{3}{8}$	18·69	1225	1·68	3·35	·076	·076
Round	$\frac{15}{16}$	1·611	$4\frac{11}{16}$	$13\frac{1}{2}$	$21\frac{3}{4}$	20·02	1406	1·73	3·42	·068	·068
Round	1	1·722	5	$13\frac{1}{2}$	$23\frac{1}{4}$	21·37	1600	1·88	3·76	·065	·065
Square	$\frac{1}{4}$	$\frac{7}{16}$	$1\frac{1}{4}$	21	$9\frac{11}{16}$	8·98	137	·70	1·39	·286	·284
Square	$\frac{1}{2}$	$\frac{15}{16}$	$2\frac{1}{2}$	21	$18\frac{7}{8}$	17·32	550	1·55	3·12	·157	·159
Square	$\frac{3}{4}$	$1\frac{21}{64}$	$3\frac{3}{4}$	21	$28\frac{1}{4}$	26·23	1237	2·02	3·98	·091	·090

SPIRAL SPRINGS MADE OF STEEL.

Tested to ascertain Compression, &c., due to different Loads applied until the Springs Closed or Broke.

Shape of Steel.	Size of Steel.	Pitch of Coils.	Mean Diameter of Coils.	Number of complete Coils.	Original Length of Spring.	Length of Spring after Test.	Working Load.	Compression produced by working load.	Load which produced permanent set.	Total compression produced by load which produced permanent set.	Load which produced permanent set divided by the working load.	Average compression due to each 112 lbs. applied before permanent set took place.	Permanent set began at	Distortion began at	Spring much distorted at	Spring closed at
	in	ins.	ins.		ins.	ins.	lbs.	in.	lbs.	ins.		in.	lbs.	lbs.	lbs.	lbs.
Square	$\frac{3}{8}$	$1\frac{5}{32}$	$1\frac{7}{8}$	7	8	$5\frac{29}{32}$	309	·40	938	1·14	3·03	·138	938	1344	1568	1792
	$\frac{7}{16}$	$1\frac{5}{16}$	$2\frac{3}{16}$	7	$9\frac{1}{4}$	$6\frac{11}{16}$	421	·41	1750	1·78	4·15	·109	1750	1897	2121	2352
	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	7	$10\frac{1}{2}$	$7\frac{1}{2}$	550	·46	2100	1·84	3·81	·097	2100	2744	2856	3192
	$\frac{9}{16}$	$1\frac{3}{4}$	$2\frac{13}{16}$	7	12	$8\frac{1}{4}$	696	·60	2772	2·34	3·98	·091	2772	2961	3188	3864
	$\frac{5}{8}$	$1\frac{15}{16}$	$3\frac{1}{8}$	7	$13\frac{5}{16}$	$10\frac{1}{2}$	859	·65	2850	2·31	3·31	·089	2850	3814	4154	4480
	$\frac{11}{16}$	$2\frac{1}{16}$	$3\frac{7}{16}$	7	$14\frac{3}{8}$	$12\frac{1}{4}$	1039	66	4440	3·12	4·27	·077	4440	5068	5520	6272
	$\frac{3}{4}$	$2\frac{5}{16}$	$3\frac{3}{4}$	7	$16\frac{1}{8}$	Broke	1237	·8	4224	3·03	3·41	·078	4224	5355	Broke at	5600
Round	$\frac{3}{8}$	$1\frac{1}{8}$	$1\frac{7}{8}$	7	8	$5\frac{3}{4}$	225	·34	700	1·05	3·11	·166	700	923	1484	1680
	$\frac{7}{16}$	$1\frac{5}{16}$	$2\frac{3}{16}$	7	$9\frac{1}{4}$	$6\frac{11}{16}$	306	·35	1099	1·40	3·59	·140	1099	1512	1610	2072
	$\frac{1}{2}$	$1\frac{1}{2}$	$2\frac{1}{2}$	7	$10\frac{1}{2}$	$7\frac{1}{2}$	400	·46	1666	2·0	4·16	·135	1666	2086	2190	2632
	$\frac{9}{16}$	$1\frac{3}{4}$	$2\frac{13}{16}$	7	12	$9\frac{3}{16}$	506	·57	1596	1·64	3·15	·113	1596	2317	2667	2912
	$\frac{5}{8}$	$1\frac{15}{16}$	$3\frac{1}{8}$	7	$13\frac{5}{16}$	$9\frac{3}{4}$	625	·68	2739	2·93	4·38	·117	2739	3267	3737	4368
	$\frac{11}{16}$	$2\frac{1}{8}$	$3\frac{7}{16}$	7	$14\frac{5}{8}$	12	756	·67	3212	3·15	4·24	·109	3212	3818	4026	4480
	$\frac{3}{4}$	$2\frac{5}{16}$	$3\frac{3}{4}$	7	$16\frac{1}{8}$	12	900	·77	3626	3·05	4·02	·093	3626	5110	5572	6048

The results of the foregoing six series of experiments fairly represent what may be expected in general practice, and although possibly by theoretical investigation, with refinements of measurements, &c., slight irregularities may be found, the results are of more practical value than if they had been selected, as they might have been, from a number of other series, to make them agree more nearly with theory. Many exactly similar conditions must exist, which are never found in practice, to insure the results from a number of series being exactly alike; for instance, the quality of steel and the temper must be the same, both the steel and springs must have exactly the same dimensions, the ends of springs must be finished in precisely the same way, &c.

Formulæ as to springs will be found in another part of the book, by the use of which results practically in accordance with a number of tests and with practice are obtained.

PROPERTIES OF SATURATED STEAM.

The following Tables, Nos. 218 to 224, giving the temperature, volume, density, cubic feet per lb., and latent heat and total heat of evaporation of one lb. of steam, have been computed at intervals of one lb. per square inch for pressures ranging from 14 lbs. per square inch below atmospheric pressure to 200 lbs. per square inch above the mean atmospheric pressure of 14·7 lbs. per square inch.

The particulars for intermediate pressures may be obtained by the following formulæ :—

P = Pressure in lbs. per square inch (absolute).
T = Temperature in degrees, Fahrenheit.
V = Relative volume of the steam.
D = Density or weight of 1 cubic foot of steam in lbs.
C = Cubic feet of the steam per lb.
l = Latent heat of evaporation in thermal units.
H = Total heat in thermal units from 32° Fahrenheit per lb. of the steam.

$$6{\cdot}2269425 - \frac{2970}{T+375} = \text{Log. } P.$$

$$\frac{2970}{6{\cdot}2269425 - \text{Log. } P} - 375 = T.$$

$$4{\cdot}3129 - {\cdot}94 \text{ Log. } P = \text{Log. } V.$$

$$\frac{V}{62{\cdot}384} = C.$$

$$\frac{1}{C} = D.$$

$$1114 - ({\cdot}695T + {\cdot}000000103(T - 39{\cdot}2)^3) = l.$$

$$1082 + {\cdot}305T = H.$$

PROPERTIES OF SATURATED STEAM.

Pressure per Square Inch from Mean Atmospheric Pressure. lbs.	Temperature in Fahrenheit Degrees.	Specific or Relative Volume of the Steam.	Density or Weight of 1 Cubic Foot of the Steam. lb.	Cubic Feet of the Steam per lb.	Latent Heat of Evaporation in Thermal Units per lb. of the Steam.	Total Heat in Thermal Units from 32° Fahrenheit per lb. of the Steam.	Absolute Pressure per Square Inch. lbs.
−14	90·4	28740	·002170	460·7	1051·1	1109·5	·7
−13	120·3	12480	·004998	200·1	1030·3	1118·6	1·7
−12	137·5	8080	·007720	129·5	1018·3	1123·9	2·7
−11	149·8	6009	·01038	96·32	1009·7	1127·6	3·7
−10	159·7	4799	·01300	76·92	1002·8	1130·7	4·7
−9	167·9	4003	·01558	64·17	997·0	1133·2	5·7
−8	174·9	3439	·01814	55·12	992·1	1135·3	6·7
−7	181·1	3010	·02072	48·25	987·8	1137·2	7·7
−6	186·7	2690	·02319	43·12	983·9	1138·9	8·7
−5	191·8	2428	·02568	38·93	980·3	1140·4	9·7
−4	196·4	2215	·02817	35·50	977·1	1141·9	10·7
−3	200·7	2036	·03063	32·64	974·0	1143·2	11·7
−2	204·7	1886	·03307	30·24	971·2	1144·4	12·7
−1	208·5	1755	·03553	28·14	968·5	1145·5	13·7
Atmosphere.	212·0	1643	·03797	26·34	966·1	1146·6	14·7
1	215·3	1544	·04039	24·76	963·8	1147·6	15·7
2	218·5	1457	·04280	23·36	961·5	1148·6	16·7
3	221·5	1380	·04521	22·12	959·4	1149·5	17·7
4	224·4	1310	·04761	21·0	957·3	1150·4	18·7
5	227·1	1248	·05000	20·0	955·4	1151·2	19·7
6	229·8	1191	·05238	19·09	953·5	1152·0	20·7
7	232·3	1139	·05475	18·26	951·8	1152·8	21·7
8	234·7	1092	·05712	17·51	950·1	1153·5	22·7
9	237·1	1049	·05949	16·81	948·4	1154·3	23·7
10	239·4	1009	·06184	16·17	946·7	1155·0	24·7
11	241·6	971·8	·06419	15·58	945·2	1155·6	25·7
12	243·7	937·5	·06654	15·03	943·7	1156·3	26·7
13	245·8	905·7	·06888	14·52	942·2	1156·9	27·7
14	247·8	876·0	·07122	14·04	940·8	1157·5	28·7
15	249·7	818·2	·07355	13·60	939·4	1158·1	29·7
16	251·6	822·2	·07587	13·18	938·1	1158·7	30·7

PROPERTIES OF SATURATED STEAM.

Pressure per Square Inch from Mean Atmospheric Pressure. lbs.	Temperature in Fahrenheit Degrees.	Specific or Relative Volume of the Steam.	Density or Weight of 1 Cubic Foot of the Steam. lb.	Cubic Feet of the Steam per lb.	Latent Heat of Evaporation in Thermal Units per lb. of the Steam.	Total Heat in Thermal Units from 32° Fahrenheit per lb. of the Steam.	Absolute Pressure per Square Inch. lbs.
17	253·5	797·8	·07819	12·79	936·8	1159·3	31·7
18	255·3	774·9	·08050	12·42	935·5	1159·8	32·7
19	257·0	753·2	·08282	12·07	934·3	1160·3	33·7
20	258·7	732·8	·08513	11·75	933·1	1160·9	34·7
21	260·4	713·5	·08743	11·44	931·9	1161·4	35·7
22	262·0	695·2	·08973	11·14	930·7	1161·9	36·7
23	263·6	677·9	·09203	10·87	929·6	1162·3	37·7
24	265·2	661·4	·09433	10·60	928·4	1162·8	38·7
25	266·7	645·7	·09661	10·35	927·4	1163·3	39·7
26	268·2	630·8	·09890	10·11	926·3	1163·8	40·7
27	269·7	616·6	·1011	9·883	925·2	1164·2	41·7
28	271·1	603·0	·1034	9·666	924·3	1164·6	42·7
29	272·6	590·0	·1057	9·458	923·2	1165·1	43·7
30	273·9	577·6	·1080	9·259	922·3	1165·5	44·7
31	275·3	565·7	·1102	9·068	921·3	1165·9	45·7
32	276·7	554·3	·1125	8·885	920·3	1166·3	46·7
33	278·0	543·4	·1148	8·710	919·3	1166·7	47·7
34	279·3	532·9	·1170	8·541	918·4	1167·1	48·7
35	280·5	522·8	·1193	8·380	917·6	1167·5	49·7
36	281·8	513·1	·1215	8·225	916·6	1167·9	50·7
37	283·0	503·8	·1238	8·075	915·8	1168·3	51·7
38	284·2	494·8	·1260	7·931	914·9	1168·6	52·7
39	285·4	486·1	·1283	7·792	914·1	1169·0	53·7
40	286·6	477 7	·1305	7·658	913·2	1169·4	54·7
41	287·8	469·7	·1328	7·529	912·3	1169·7	55·7
42	288·9	461·9	·1350	7·404	911·6	1170·1	56·7
43	290·1	454·4	·1373	7·283	910·7	1170·4	57·7
44	291·2	447·1	·1395	7·167	909·9	1170·8	58·7
45	292·3	440·0	·1417	7·054	909·1	1171·1	59·7
46	293·4	433·2	·1440	6·944	908·3	1171·4	60·7
47	294·4	426·6	·1462	6·839	907·6	1171·7	61·7

PROPERTIES OF SATURATED STEAM.

Pressure per Square Inch from Mean Atmospheric Pressure. lbs.	Temperature in Fahrenheit Degrees.	Specific or Relative Volume of the Steam.	Density or Weight of 1 Cubic Foot of the Steam. lb.	Cubic Feet of the Steam per lb.	Latent Heat of Evaporation in Thermal Units per lb. of the Steam.	Total Heat in Thermal Units from 32° Fahrenheit per lb. of the Steam.	Absolute Pressure per Square Inch. lbs.
48	295·5	420·2	·1484	6·736	906·8	1172·1	62·7
49	296·5	414·1	·1506	6·636	906·1	1172·4	63·7
50	297·5	408·0	·1529	6·540	905·4	1172·7	64·7
51	298·6	402·2	·1551	6·446	904·6	1173·0	65·7
52	299·6	396·5	·1573	6·356	903·9	1173·3	66·7
53	300·6	391·0	·1595	6·267	903·2	1173·6	67·7
54	301·5	385·6	·1617	6·181	902·5	1173·9	68·7
55	302·5	380·4	·1639	6·098	901·8	1174·2	69·7
56	303·5	375·4	·1661	6·017	901·1	1174·5	70·7
57	304·4	370·4	·1684	5·938	900·5	1174·8	71·7
58	305·3	365·6	·1706	5·861	899·8	1175·1	72·7
59	306·3	361·0	·1728	5·786	899·1	1175·4	73·7
60	307·2	356·4	·1750	5·714	898·5	1175·6	74·7
61	308·1	352·0	·1772	5·643	897·8	1175·9	75·7
62	309·0	347·7	·1794	5·573	897·2	1176·2	76·7
63	309·9	343·5	·1816	5·506	896·5	1176·5	77·7
64	310·8	339·4	·1838	5·440	895·9	1176·7	78·7
65	311·6	335·4	·1860	5·376	895·3	1177·0	79·7
66	312·5	331·5	·1882	5·313	894·7	1177·3	80·7
67	313·3	327·7	·1904	5·252	894·1	1177·5	81·7
68	314·2	323·9	·1926	5·192	893·4	1177·8	82·7
69	315·0	320·3	·1947	5·134	892·9	1178·0	83·7
70	315·8	316·7	·1969	5·077	892·3	1178·3	84·7
71	316·7	313·3	·1991	5·021	891·6	1178·5	85·7
72	317·5	309·9	·2013	4·967	891·1	1178·8	86·7
73	318·3	306·5	·2035	4·914	890·5	1179·0	87·7
74	319·1	303·3	·2056	4·862	889·9	1179·3	88·7
75	319·9	300·1	·2078	4·811	889·3	1179·5	89·7
76	320·7	297·0	·2100	4·761	888·8	1179·8	90·7
77	321·4	294·0	·2122	4·712	888·3	1180·0	91·7
78	322·2	291·0	·2144	4·664	887·7	1180·2	92·7

PROPERTIES OF SATURATED STEAM.

Pressure per Square Inch from Mean Atmospheric Pressure. lbs.	Temperature in Fahrenheit Degrees.	Specific or Relative Volume of the Steam.	Density or Weight of 1 Cubic Foot of the Steam. lb.	Cubic Feet of the Steam per lb.	Latent Heat of Evaporation in Thermal Units per lb. of the Steam.	Total Heat in Thermal Units from 32° Fahrenheit per lb. of the Steam.	Absolute Pressure per Square Inch. lbs.
79	323·0	288·0	·2165	4·617	887·1	1180·5	93·7
80	323·8	285·2	·2187	4·572	886·5	1180·7	94·7
81	324·5	282·4	·2209	4·527	886·0	1180·9	95·7
82	325·2	279·6	·2230	4·483	885·5	1181·1	96·7
83	326·0	276·9	·2252	4·439	885·0	1181·4	97·7
84	326·7	274·3	·2274	4·397	884·4	1181·6	98·7
85	327·4	271·7	·2295	4·356	883·9	1181·8	99·7
86	328·1	269·2	·2317	4·315	883·4	1182·0	100·7
87	328·9	266·7	·2339	4·275	882·9	1182·3	101·7
88	329·6	264·3	·2360	4·236	882·4	1182·5	102·7
89	330·3	261·9	·2382	4·198	881·9	1182·7	103·7
90	331·0	259·5	·2404	4·160	881·3	1182·9	104·7
91	331·7	257·2	·2425	4·123	880·8	1183·1	105·7
92	332·3	254·9	·2447	4·087	880·4	1183·3	106·7
93	333·0	252·5	·2468	4·051	879·9	1183·5	107·7
94	333·7	250·5	·2490	4·016	879·4	1183·7	108·7
95	334·4	248·4	·2511	3·981	878·9	1183·9	109·7
96	335·1	246·3	·2533	3·948	878·4	1184·2	110·7
97	335·7	244·2	·2554	3·914	878·0	1184·3	111·7
98	336·4	242·2	·2576	3·882	877·4	1184·6	112·7
99	337·0	240·1	·2598	3·849	877·0	1184·7	113·7
100	337·7	238·2	·2619	3·818	976·5	1184·9	114·7
101	338·3	236·2	·2640	3·787	876·1	1185·1	115·7
102	339·0	234·3	·2662	3·757	875·6	1185·3	116·7
103	339·6	232·5	·2683	3·727	875·1	1185·5	117·7
104	340·2	230·6	·2704	3·697	874·7	1185·7	118·7
105	340·9	228·8	·2726	3·668	874·2	1185·9	119·7
106	341·5	227·0	·2747	3·639	873·8	1186·1	120·7
107	342·1	225·1	·2769	3·611	873·3	1186·3	121·7
108	342·7	223·6	·2790	3·584	872·9	1186·5	122·7
109	343·3	221·9	·2811	3·556	872·5	1186·7	123·7

PROPERTIES OF SATURATED STEAM.

Pressure per Square Inch from Mean Atmospheric Pressure. lbs.	Temperature in Fahrenheit Degrees.	Specific or Relative Volume of the Steam.	Density or Weight of 1 Cubic Foot of the Steam. lb.	Cubic Feet of the Steam per lb.	Latent Heat of Evaporation in Thermal Units per lb. of the Steam.	Total Heat in Thermal Units from 32° Fahrenheit per lb. of the Steam.	Absolute Pressure per Square Inch. lbs.
110	343·9	220·1	·2833	3·530	872·0	1186·8	124·7
111	344·5	218·5	·2854	3·503	871·6	1187·0	125·7
112	345·1	216·9	·2875	3·477	871·2	1187·2	126·7
113	345·7	215·3	·2897	3·452	870·7	1187·4	127·7
114	346·3	213·7	·2918	3·426	870·3	1187·6	128·7
115	346·9	212·2	·2939	3·401	869·9	1187·8	129·7
116	347·5	210·7	·2961	3·377	869·4	1187·9	130·7
117	348·1	209·2	·2982	3·353	869·0	1188·1	131·7
118	348·7	207·7	·3003	3·329	868·6	1188·3	132·7
119	349·2	206·2	·3025	3·306	868·2	1188·5	133·7
120	349·8	204·8	·3046	3·283	867·8	1188·6	134·7
121	350·4	203·4	·3067	3·260	867·3	1188·8	135·7
122	351·0	202·0	·3088	3·237	866·9	1189·0	136·7
123	351·5	200·6	·3110	3·215	866·5	1189·2	137·7
124	352·1	199·2	·3131	3·194	866·1	1189·3	138·7
125	352·6	197·9	·3152	3·172	865·7	1189·5	139·7
126	353·2	196·6	·3173	3·151	865·3	1189·7	140·7
127	353·7	195·3	·3194	3·130	864·9	1189·8	141·7
128	354·3	194·0	·3216	3·109	864·5	1190·0	142·7
129	354·8	192·7	·3237	3·089	864·1	1190·2	143·7
130	355·4	191·5	·3258	3·069	863·7	1190·3	144·7
131	355·9	190·2	·3279	3·049	863·3	1190·5	145·7
132	356·4	189·0	·3300	3·030	863·0	1190·7	146·7
133	357·0	187·8	·3321	3·010	862·5	1190·8	147·7
134	357·5	186·6	·3343	2·991	862·2	1191·0	148·7
135	358·0	185·4	·3364	2·973	861·8	1191·1	149·7
136	358·5	184·3	·3385	2·954	861·4	1191·3	150·7
137	359·1	182·9	·3406	2·936	861·0	1191·5	151·7
138	359·6	182·0	·3427	2·918	860·6	1191·6	152·7
139	360·1	180·9	·3448	2·900	860·3	1191·8	153·7
140	360·6	179·8	·3469	2·882	859·9	1191·9	154·7

PROPERTIES OF SATURATED STEAM.

Pressure per Square Inch from Mean Atmospheric Pressure. lbs.	Temperature in Fahrenheit Degrees.	Specific or Relative Volume of the Steam.	Density or Weight of 1 Cubic Foot of the Steam. lb.	Cubic Feet of the Steam per lb.	Latent Heat of Evaporation in Thermal Units per lb. of the Steam.	Total Heat in Thermal Units from 32° Fahrenheit per lb. of the Steam.	Absolute Pressure per Square Inch. lbs.
141	361·1	178·7	·3490	2·865	859·6	1192·1	155·7
142	361·6	177·6	·3511	2·848	859·2	1192·2	156·7
143	362·1	176·6	·3532	2·831	858·8	1192·4	157·7
144	362·6	175·5	·3554	2·814	858·5	1192·5	158·7
145	363·1	174·5	·3575	2·797	858·1	1192·7	159·7
146	363·6	173·5	·3596	2·781	857·7	1192·8	160·7
147	364·1	172·5	·3617	2·765	857·4	1193·0	161·7
148	364·6	171·5	·3638	2·749	857·0	1193·2	162·7
149	365·1	170·5	·3659	2·733	856·6	1193·3	163·7
150	365·6	169·5	·3680	2·717	856·3	1193·5	164·7
151	366·1	168·6	·3701	2·702	855·9	1193·6	165·7
152	366·6	167·6	·3722	2·687	855·5	1193·8	166·7
153	367·1	166·7	·3743	2·672	855·2	1193·9	167·7
154	367·5	165·7	·3764	2·657	854·9	1194·0	168·7
155	368·0	164·8	·3785	2·642	854·5	1194·2	169·7
156	368·5	163·9	·3806	2·627	854·2	1194·3	170·7
157	369·0	163·0	·3827	2·613	853·8	1194·5	171·7
158	369·4	162·1	·3847	2·599	853·5	1194·6	172·7
159	369·9	161·2	·3868	2·585	853·1	1194·8	173·7
160	370·4	160·4	·3889	2·571	852·8	1194·9	174·7
161	370·8	159·5	·3910	2·557	852·5	1195·0	175·7
162	371·3	158·7	·3931	2·543	852·1	1195·2	176·7
163	371·7	157·8	·3952	2·530	851·8	1195·3	177·7
164	372·2	157·0	·3973	2·517	851·5	1195·5	178·7
165	372·7	156·2	·3994	2·504	851·1	1195·6	179·7
166	373·1	155·4	·4015	2·491	850·8	1195·7	180·7
167	373·6	154·6	·4036	2·478	850·4	1195·9	181·7
168	374·0	153·8	·4057	2·465	850·2	1196·0	182·7
169	374·5	153·0	·4077	2·452	849·8	1196·2	183·7
170	374·9	152·2	·4098	2·440	849·5	1196·3	184·7
171	375·4	151·4	·4119	2·427	849·1	1196·4	185·7

PROPERTIES OF SATURATED STEAM.

Pressure per Square Inch from Mean Atmospheric Pressure. lbs.	Temperature in Fahrenheit Degrees.	Specific or Relative Volume of the Steam.	Density or Weight of 1 Cubic Foot of the Steam. lb.	Cubic Feet of the Steam per lb.	Latent Heat of Evaporation in Thermal Units per lb. of the Steam.	Total Heat in Thermal Units from 32° Fahrenheit per lb. of the Steam.	Absolute Pressure per Square Inch. lbs.
172	375·8	150·7	·4140	2·415	848·8	1196·6	186·7
173	376·2	149·9	·4161	2·403	848·5	1196·7	187·7
174	376·7	149·2	·4182	2·391	848·2	1196·8	188·7
175	377·1	148·4	·4203	2·379	847·9	1197·0	189·7
176	377·5	147·7	·4223	2·368	847·6	1197·1	190·7
177	378·0	147·0	·4244	2·356	847·2	1197·2	191·7
178	378·4	146·3	·4265	2·344	846·9	1197·4	192·7
179	378·8	145·5	·4286	2·333	846·7	1197·5	193·7
180	379·3	144·8	·4307	2·322	846·3	1197·6	194·7
181	379·7	144·1	·4327	2·311	846·0	1197·8	195·7
182	380·1	143·5	·4348	2·300	845·7	1197·9	196·7
183	380·5	142·8	·4369	2·289	845·4	1198·0	197·7
184	381·0	142·1	·4390	2·278	845·0	1198·2	198·7
185	381·4	141·4	·4410	2·267	844·8	1198·3	199·7
186	381·8	140·8	·4431	2·257	844·5	1198·4	200·7
187	382·2	140·1	·4452	2·246	844·2	1198·5	201·7
188	382·6	139·5	·4473	2·236	843·9	1198·6	202·7
189	383·0	138·8	·4493	2·225	843·6	1198·8	203·7
190	383·5	138·2	·4514	2·215	843·2	1198·9	204·7
191	383·9	137·5	·4535	2·205	842·9	1199·0	205·7
192	384·3	136·9	·4556	2·195	842·6	1199·2	206·7
193	384·7	136·3	·4576	2·185	842·3	1199·3	207·7
194	385·1	135·7	·4597	2·175	842·0	1199·4	208·7
195	385·5	135·1	·4618	2·165	841·8	1199·5	209·7
196	385·9	134·5	·4639	2·156	841·5	1199·6	210·7
197	386·3	133·9	·4659	2·146	841·2	1199·8	211·7
198	386·7	133·3	·4680	2·137	840·9	1199·9	212·7
199	387·1	132·7	·4701	2·127	840·6	1200·0	213·7
200	387·5	132·1	·4721	2·118	840·3	1200·1	214·7

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{1}{4}$ inch thick.

TABLE No. 225.

Pressure per. sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	4·21	17·7	4·04	16·3	3·81	14·5	3·50	12·2	...	...	...	...	...	...
170	...	...	...	...	4·16	17·3	3·98	15·8	3·75	14·1	...	...	...	...	...	...	...	...
175	...	...	...	...	4·11	16·9	3·92	15·4	3·70	13·7	...	...	...	...	...	...	...	...
180	...	...	...	...	4·07	16·5	3·87	15·0	3·65	13·3	...	...	...	...	...	...	..	...
185	...	...	...	...	4·02	16·2	3·82	14·5	3·60	12·9	...	...	...	...	...	...	...	...
190	...	...	...	...	3·97	15·7	3·77	14·2	3·55	12·6	...	...	...	...	...	...	...	...
195	...	...	...	...	3·92	15·3	3·72	13·8	3·50	12·3	...	...	...	...	...	...	...	...
200	...	...	...	...	3·87	15·0	3·67	13·5	...	...	...	...	...	...	...	...	...	...
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{9}{32}$ inch thick.

TABLE No. 226.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	4·58	21·0	4·37	19·1	4·16	17·3	3·85	14·8	3·63	13·2	...	...	...	...
170	...	...	...	...	4·52	20·4	4·31	18·6	4·11	16·8	3·79	14·4	3·58	12·8	...	...	...	...
175	...	...	...	...	4·46	19·9	4·26	18·1	4·06	16·5	3·74	14·0	3·52	12·4	...	...	...	...
180	...	...	...	...	4·41	19·4	4·21	17·7	4·01	16·1	3·69	13·6	...	...	...	...	...	...
185	...	...	...	...	4·35	18·9	4·16	17·3	3·96	15·6	3·64	13·2	...	...	...	...	...	...
190	...	...	...	...	4·30	18·5	4·12	16·9	3·91	15·2	3·59	12·8	...	...	...	...	...	...
195	...	...	...	...	4·26	18·1	4·07	16·6	3·86	14·8	3·54	12·5	...	...	...	...	...	...
200	...	...	...	...	4·21	17·7	4·03	16·3	3·81	14·5	3·50	12·2	...	...	...	...	...	...
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{5}{16}$ inch thick.

TABLE No. 227.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	4·99	24·9	4·74	22·4	4·48	20·1	4·16	17·3	3·96	15·7	3·76	14·1	...	...
170	...	...	...	...	4·92	24·2	4·67	21·8	4·42	19·5	4·11	16·9	3·90	15·2	3·70	13·7	...	...
175	...	...	...	...	4·85	23·5	4·61	21·2	4·37	19·0	4·07	16·5	3·84	14·8	3·65	13·3	...	...
180	...	...	...	...	4·78	22·8	4·55	20·7	4·31	18·6	4·02	16·2	3·79	14·4	3·60	12·9	...	...
185	...	...	...	...	4·72	22·2	4·49	20·1	4·26	18·1	3·97	15·7	3·74	14·0	3·55	12·6	...	...
190	...	...	...	...	4·66	21·7	4·44	19·7	4·21	17·7	3·91	15·3	3·69	13·6	3·50	12·2	..	...
195	...	...	...	...	4·60	21·1	4·38	19·2	4·17	17·4	3·86	14·9	3·64	13·2	...	...	...	...
200	...	...	...	...	4·55	20·7	4·34	18·8	4·13	17·0	3·81	14·5	3·60	12·9	...	...	...	...
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{11}{32}$ inch thick.

TABLE No. 228.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins	ins.	sq. ins.	ins.	sq. ins.	ins.	sq ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	5·43	29·5	5·13	26·3	4·84	23·4	4·46	19·9	4·24	17·9	4·06	16·5	...	...
170	...	...	...	...	5·35	28·6	5·06	25·5	4·77	22·7	4·40	19·4	4·19	17·5	4·01	16·1	...	...
175	...	...	...	...	5·26	27·7	4·98	24·8	4·70	22·1	4·35	18·9	4·14	17·1	3·95	15·6	...	...
180	...	...	...	...	5·18	26·9	4·91	24·1	4·64	21·5	4·29	18·4	4·09	16·7	3·90	15·2	...	...
185	...	...	...	...	5·11	26·1	4·84	23·4	4·58	20·9	4·24	18·0	4·04	16·3	3·84	14·7	...	...
190	...	...	...	...	5·04	25·4	4·78	22·8	4·52	20·4	4·20	17·6	4·00	16·0	3·79	14·4	...	...
195	...	...	...	...	4·97	24·7	4·72	22·3	4·47	19·9	4·15	17·2	3·95	15·6	3·74	14·0	...	...
200	...	...	...	...	4·91	24·1	4·66	21·7	4·42	19·5	4·11	16·9	3·90	15·2	3·70	13·6	...	...
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{3}{8}$ inch thick.

TABLE No. 229.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	5·91	34·9	5·56	31·0	5·22	27·2	4·78	22·9	4·52	20·5	4·32	18·6	3·58	12·8
170	...	..	...	...	5·81	33·7	5·47	29·9	5·14	26·4	4·72	22·2	4·46	19·9	4·26	18·1	3·52	12·4
175	...	...	...	...	5·71	32·6	5·39	29·0	5·06	25·6	4·65	21·6	4·41	19·4	4·21	17·7	3·47	12·0
180	...	...	...	...	5·62	31·6	5·30	28·1	4·99	24·9	4·59	21·0	4·35	18·9	4·16	17·3	...	...
185	...	...	...	...	5·54	30·6	5·23	27·3	4·92	24·2	4·53	20·5	4·30	18·5	4·11	16·9	...	...
190	...	...	...	...	5·45	29·7	5·15	26·5	4·85	23·5	4·48	20·0	4·25	18·1	4·07	16·5	...	...
195	...	...	...	...	5·38	28·9	5·08	25·8	4·79	22·9	4·42	19·6	4·20	17·7	4·03	16·2	...	...
200	...	...	...	...	5·30	28·1	5·02	25·2	4·73	22·4	4·38	19·1	4·16	17·3	3·98	15·8	...	...
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{13}{32}$ inch thick.

TABLE No. 230.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	6·33	40·0	6·03	36·3	5·63	31·7	5·13	26·3	4·83	23·3	4·59	21·1	3·83	14·7
170	...	...	...	...	6·25	39·0	5·92	35·0	5·53	30·6	5·05	25·5	4·76	22·7	4·53	20·5	3·78	14·2
175	...	...	...	...	6·17	38·1	5·82	33·9	5·45	29·7	4·98	24·8	4·70	22·0	4·47	20·0	3·72	13·8
180	...	...	...	...	6·09	37·1	5·73	32·8	5·36	28·7	4·91	24·1	4·63	21·5	4·41	19·5	3·67	13·5
185	...	...	...	...	5·99	35·9	5·64	31·8	5·28	27·9	4·84	23·4	4·57	20·9	4·36	19·0	3·62	13·1
190	...	...	...	...	5·90	34·8	5·55	30·8	5·21	27·1	4·78	22·8	4·52	20·4	4·31	18·6	3·57	12·7
195	...	...	...	...	5·81	33·8	5·47	30·0	5·14	26·4	4·72	22·2	4·47	19·9	4·26	18·2	3·53	12·4
200	...	...	...	...	5·73	32·8	5·40	29·1	5·07	25·7	4·66	21·7	4·41	19·5	4·22	17·8	...	...
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{7}{16}$ inch thick.

TABLE No. 231.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	6·69	44·7	6·39	40·9	6·07	36·8	5·50	30·2	5·16	26·6	4·89	23·9	4·08	16·6
170	...	...	...	...	6·60	43·6	6·31	39·8	5·96	35·5	5·41	29·3	5·08	25·8	4·82	23·2	4·03	16·2
175	...	...	...	...	6·52	42·5	6·23	38·9	5·86	34·3	5·33	28·4	5·01	25·1	4·75	22·6	3·97	15·7
180	...	...	...	...	6·44	41·5	6·16	38·0	5·76	33·2	5·25	27·5	4·93	24·3	4·69	21·9	3·92	15·3
185	...	...	...	...	6·37	40·5	6·08	36·9	5·67	32·2	5·17	26·7	4·87	23·7	4·63	21·4	3·86	14·9
190	...	...	...	...	6·30	39·6	5·98	35·8	5·59	31·2	5·10	26·0	4·80	23·1	4·57	20·9	3·81	14·5
195	...	...	...	...	6·23	38·8	5·89	34·7	5·51	30·3	5·03	25·3	4·74	22·5	4·51	20·4	3·76	14·1
200	...	...	...	...	6·16	38·0	5·81	33·7	5·43	29·5	4·97	24·7	4·69	21·9	4·46	19·9	3·71	13·8
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{15}{32}$ inch thick.

TABLE No. 232.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	7·05	49·7	6·73	45·4	6·40	41·0	5·89	34·7	5·51	30·4	5·20	27·1	4·29	18·3
170	...	...	..	...	6·96	48·5	6·65	44·2	6·32	40·0	5·79	33·5	5·42	29·4	5·12	26·2	4·23	17·9
175	...	...	...	...	6·87	47·2	6·57	43·1	6·24	39·0	5·70	32·5	5·34	28·5	5·05	25·5	4·18	17·5
180	...	...	...	...	6·79	46·1	6·49	42·1	6·17	38·1	5·61	31·4	5·26	27·6	4·97	24·7	4·13	17·0
185	...	...	...	...	6·71	45·0	6·41	41·1	6·09	37·1	5·52	30·5	5·18	26·8	4·91	24·1	4·09	16·7
190	...	...	...	...	6·63	44·0	6·34	40·2	6·00	36·0	5·44	29·6	5·11	26·1	4·84	23·4	4·04	16·3
195	...	...	...	...	6·56	43·0	6·27	39·3	5·90	34·9	5·36	28·8	5·04	25·4	4·78	22·8	4·0	16·0
200	...	...	...	...	6·49	42·1	6·20	38·5	5·82	33·8	5·29	28·0	4·97	24·7	4·72	22·3	3·95	15·6
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{1}{2}$ inch thick.

TABLE No. 233.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	9·19	84·5	...	...	7·42	55·0	7·08	50·1	6·72	45·2	6·25	39·1	5·88	34·6	5·54	30·7	4·51	20·3
170	9·06	82·2	...	...	7·32	53·6	6·99	48·8	6·64	44·1	6·17	38·1	5·78	33·4	5·45	29·7	4·45	19·8
175	...	...	...	...	7·23	52·2	6·90	47·6	6·56	43·0	6·09	37·1	5·69	32·3	5·36	28·7	4·39	19·3
180	...	...	...	...	7·14	51·0	6·82	46·5	6·48	42·0	5·99	35·9	5·60	31·3	5·28	27·9	4·34	18·8
185	...	...	...	...	7·05	49·7	6·73	45·4	6·40	41·0	5·89	34·7	5·51	30·4	5·20	27·1	4·28	18·3
190	...	...	...	...	6·97	48·6	6·66	44·3	6·33	40·1	5·80	33·7	5·43	29·5	5·13	26·3	4·24	17·9
195	...	...	...	...	6·89	47·5	6·58	43·3	6·26	39·2	5·72	32·7	5·35	28·6	5·06	25·6	4·19	17·5
200	...	...	..	...	6·82	46·5	6·51	42·4	6·19	38·4	5·64	31·7	5·28	27·9	5·00	25·0	4·15	17·2
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{17}{32}$ inch thick.

TABLE No. 234.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	9·67	93·5	9·38	88·0	7·79	60·6	7·43	55·2	7·05	49·7	6·55	42·9	6·23	38·8	5·89	34·7	4·74	22·5
170	9·53	90·9	9·25	85·6	7·68	59·0	7·33	53·7	6·96	48·4	6·46	41·8	6·15	37·8	5·79	33·5	4·68	21·8
175	9·40	88·5	9·13	83·3	7·58	57·5	7·24	52·4	6·87	47·2	6·38	40·8	6·06	36·7	5·70	32·4	4·61	21·3
180	9·28	86·2	9·01	81·2	7·49	56·1	7·15	51·1	6·79	46·1	6·31	39·8	5·96	35·5	5·60	31·4	4·55	20·7
185	9·16	84·0	...	...	7·40	54·7	7·06	49·9	6·71	45·0	6·24	38·9	5·86	34·3	5·52	30·5	4·49	20·2
190	9·05	82·0	...	...	7·31	53·5	6·98	48·7	6·63	44·0	6·17	38·0	5·77	33·3	5·44	29·6	4·44	19·7
195	...	...	...	...	7·23	52·2	6·90	47·6	6·56	43·0	6·09	37·1	5·69	32·3	5·36	28·7	4·39	19·2
200	...	...	...	...	7·15	51·1	6·82	46·6	6·48	42·1	6·00	36·0	5·60	31·4	5·29	28·0	4·34	18·8
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{9}{16}$ inch thick.

TABLE NO. 235.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	10·14	102·9	9·84	96·9	8·16	66·6	7·78	60·5	7·38	54·4	6·85	46·9	6·50	42·3	6·22	38·7	5·0	25·0
170	10·00	100·0	9·70	94·2	8·05	64·8	7·67	58·9	7·28	53·0	6·76	45·7	6·42	41·2	6·14	37·7	4·92	24·2
175	9·87	97·4	9·57	91·7	7·94	63·1	7·57	57·4	7·19	51·7	6·67	44·5	6·34	40·2	6·05	36·6	4·85	23·5
180	9·74	94·8	9·45	89·3	7·84	61·5	7·48	56·0	7·10	50·4	6·59	43·5	6·27	39·3	5·95	35·4	4·78	22·8
185	9·61	92·4	9·33	87·0	7·75	60·0	7·39	54·6	7·01	49·2	6·51	42·4	6·20	38·4	5·85	34·2	4·72	22·2
190	9·49	90·2	9·21	84·9	7·65	58·6	7·30	53·3	6·93	48·1	6·44	41·5	6·13	37·5	5·76	33·2	4·66	21·7
195	9·38	88·0	9·10	82·9	7·56	57·2	7·22	52·1	6·85	47·0	6·37	40·6	6·04	36·4	5·68	32·2	4·60	21·1
200	9·27	86·0	9·00	81·0	7·48	56·0	7·14	51·0	6·78	46·0	6·30	39·7	5·95	35·4	5·60	31·3	4·55	20·7
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{19}{32}$ inch thick.

TABLE No. 236.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	10·62	112·9	10·30	106·2	8·53	72·8	8·13	66·1	7·71	59·4	7·14	51·1	6·79	46·0	6·48	42·0	5·25	27·6
170	10·47	109·7	10·16	103·2	8·41	70·8	8·02	64·3	7·60	57·8	7·05	49·7	6·70	44·9	6·40	41·0	5·17	26·7
175	10·33	106·8	10·02	100·5	8·30	69·0	7·91	62·7	7·51	56·4	6·96	48·5	6·61	43·8	6·32	40·0	5·09	25·9
180	10·19	104·0	9·89	97·8	8·20	67·2	7·81	61·1	7·41	55·0	6·88	47·3	6·53	42·7	6·25	39·0	5·02	25·2
185	10·06	101·3	9·76	95·3	8·10	65·5	7·72	59·6	7·32	53·6	6·79	46·2	6·46	41·7	6·18	38·1	4·95	24·5
190	9·94	98·8	9·64	93·0	8·00	64·0	7·63	58·2	7·24	52·4	6·72	45·1	6·38	40·8	6·10	37·2	4·88	23·8
195	9·82	96·4	9·53	90·8	7·90	62·5	7·54	56·8	7·15	51·2	6·64	44·1	6·31	39·9	6·01	36·1	4·82	23·2
200	9·70	94·2	9·41	88·6	7·81	61·1	7·45	55·6	7·07	50·1	6·57	43·2	6·25	39·0	5·92	35·0	4·76	22·7
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{5}{8}$ inch thick.

TABLE No. 237.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	11·10	123·3	10·77	116·0	8·90	79·3	8·48	72·0	8·04	64·6	7·45	55·5	7·07	50·0	6·75	45·6	5·53	30·5
170	10·95	119·8	10·62	112·7	8·78	77·1	8·37	70·0	7·93	62·9	7·35	54·0	6·97	48·7	6·66	44·4	5·44	29·5
175	10·84	117·6	10·47	109·7	8·66	75·1	8·26	68·2	7·83	61·3	7·25	52·6	6·89	47·4	6·58	43·3	5·35	28·6
180	10·65	113·5	10·33	106·8	8·55	73·2	8·15	66·5	7·73	59·7	7·16	51·3	6·80	46·3	6·50	42·3	5·27	27·8
185	10·51	110·6	10·20	104·1	8·45	71·4	8·05	64·8	7·63	58·3	7·08	50·1	6·72	45·2	6·42	41·3	5·19	27·0
190	10·38	107·8	10·07	101·5	8·34	69·6	7·95	63·3	7·54	56·9	6·99	48·9	6·65	44·2	6·35	40·3	5·12	26·2
195	10·26	105·2	9·95	99·0	8·25	68·0	7·86	61·8	7·46	55·6	6·92	47·8	6·57	43·2	6·28	39·5	5·05	25·5
200	10·14	102·8	9·83	96·7	8·15	66·5	7·77	60·4	7·37	54·4	6·84	46·8	6·50	42·3	6·21	38·6	4·99	24·9
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{21}{32}$ inch thick.

TABLE NO. 238.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	11·58	134·2	11·23	126·2	9·28	86·1	8·84	78·1	8·37	70·1	7·75	60·1	7·35	54·0	7·02	49·2	5·81	33·8
170	11·42	130·4	11·07	122·6	9·15	83·7	8·71	76·0	8·26	68·2	7·65	58·5	7·25	52·6	6·92	48·0	5·71	32·6
175	11·26	126·9	10·92	119·3	9·03	81·5	8·60	74·0	8·15	66·4	7·55	57·0	7·16	51·3	6·84	46·8	5·62	31·6
180	11·11	123·5	10·78	116·2	8·91	79·4	8·49	72·1	8·04	64·7	7·45	55·5	7·07	50·0	6·75	45·6	5·53	30·6
185	10·97	120·3	10·64	113·2	8·80	77·4	8·33	70·3	7·95	63·1	7·36	54·2	6·99	48·8	6·67	44·6	5·45	29·7
190	10·83	117·3	10·50	110·4	8·69	75·6	8·28	68·6	7·85	61·6	7·27	52·9	6·91	47·7	6·60	43·5	5·37	28·8
195	10·70	114·5	10·38	107·7	8·59	73·8	8·18	67·0	7·76	60·2	7·19	51·7	6·83	46·6	6·52	42·6	5·29	28·0
200	10·57	111·8	10·25	105·1	8·49	72·1	8·09	65·5	7·67	58·9	7·11	50·6	6·75	45·6	6·45	41·7	5·22	27·3
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{11}{16}$ inch thick.

TABLE No. 239.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	12·06	145·6	11·70	136·9	9·65	93·2	9·19	84·5	8·70	75·8	8·05	64·9	7·64	58·3	7·28	53·1	6·11	37·4
170	11·89	141·5	11·53	133·0	9·52	90·7	9·06	82·2	8·58	73·7	7·94	63·1	7·53	56·8	7·19	51·7	6·00	36·0
175	11·73	137·6	11·37	129·4	9·39	88·2	8·94	80·0	8·47	71·8	7·84	61·5	7·44	55·3	7·10	50·4	5·90	34·8
180	11·57	134·0	11·22	126·0	9·27	86·0	8·83	78·0	8·36	70·0	7·74	60·0	7·34	54·0	7·01	49·2	5·81	33·7
185	11·42	130·5	11·08	122·7	9·15	83·8	8·72	76·0	8·26	68·2	7·65	58·5	7·26	52·7	6·93	48·0	5·72	32·7
190	11·28	127·2	10·94	119·6	9·04	81·7	8·61	74·2	8·16	66·6	7·56	57·1	7·17	51·4	6·85	46·9	5·63	31·7
195	11·14	124·1	10·80	116·7	8·93	79·8	8·51	72·4	8·06	65·0	7·47	55·8	7·09	50·3	6·77	45·8	5·55	30·8
200	11·01	121·2	10·67	114·0	8·83	78·0	8·41	70·8	7·97	63·6	7·39	54·6	7·01	49·2	6·70	44·8	5·47	29·9
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{23}{32}$ inch thick.

TABLE No. 240.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins,	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	12·55	157·5	12·16	148·0	10·03	100·6	9·55	91·2	9·04	81·7	8·36	69·9	7·92	62·8	7·55	57·1	6·33	40·0
170	12·37	153·0	11·99	143·8	9·89	97·9	9·42	88·7	8·91	79·5	8·24	68·0	7·82	61·1	7·45	55·6	6·25	39·0
175	12·20	148·0	11·83	139·9	9·76	95·2	9·29	86·3	8·80	77·4	8·14	66·2	7·71	59·5	7·36	54·2	6·17	38·1
180	12·03	144·8	11·67	136·2	9·63	92·8	9·17	84·1	8·68	75·4	8·03	64·5	7·62	58·0	7·27	52·8	6·09	37·1
185	11·88	141·1	11·52	132·6	9·51	90·4	9·05	82·0	8·57	73·5	7·93	63·0	7·52	56·6	7·18	51·6	5·99	35·9
190	11·73	137·5	11·37	129·3	9·39	88·2	8·94	80·0	8·47	71·7	7·84	61·5	7·44	55·3	7·10	50·4	5·90	34·8
195	11·58	134·2	11·23	126·1	9·28	86·1	8·83	78·1	8·37	70·1	7·75	60·0	7·35	54·0	7·02	49·2	5·81	33·8
200	11·44	131·0	11·09	123·1	9·17	84·1	8·73	76·3	8·27	68·5	7·66	58·7	7·27	52·8	6·94	48·1	5·73	32·8
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressure, Pitches, and Surfaces.

Iron Plate $\frac{3}{4}$ inch thick.

TABLE No. 241.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	13·03	169·8	12·63	159·6	10·41	108·4	9·90	98·1	9·37	87·9	8·66	75·1	8·21	67·4	7·83	61·3	6·54	42·8
170	12·84	165·0	12·45	155·1	10·26	105·4	9·77	95·4	9·24	85·5	8·55	73·1	8·10	65·6	7·72	59·6	6·46	41·7
175	12·67	160·5	12·28	150·8	10·12	102·5	9·64	92·9	9·12	83·2	8·43	71·1	7·99	63·9	7·62	58·1	6·38	40·7
180	12·49	156·2	12·11	146·8	9·99	99·8	9·51	90·5	9·00	81·0	8·33	69·3	7·89	62·3	7·53	56·7	6·30	39·8
185	12·33	152·1	11·96	143·0	9·86	97·3	9·39	88·2	8·89	79·0	8·22	67·6	7·79	60·8	7·43	55·3	6·23	38·8
190	12·17	148·3	11·80	139·4	9·74	94·9	9·27	86·0	8·78	77·1	8·12	66·0	7·70	59·3	7·35	54·0	6·16	38·0
195	12·02	144·6	11·66	136·0	9·62	92·6	9·16	84·0	8·68	75·3	8·03	64·5	7·61	58·0	7·26	52·8	6·09	37·0
200	11·82	141·2	11·52	132·7	9·51	90·5	9·05	82·0	8·58	73·6	7·94	63·0	7·53	56·7	7·18	51·6	6·00	36·0
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{25}{32}$ inch thick.

TABLE No. 242.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Sur face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face	Pitch	Sur-face
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	13·51	182·7	13·10	171·6	10·79	116·4	10·26	105·4	9·71	94·3	8·97	80·5	8·50	72·2	8·10	65·6	6·76	45·7
170	13·32	177·5	12·91	166·8	10·64	113·2	10·12	102·4	9·58	91·7	8·85	78·3	8·38	70·3	7·99	63·8	6·67	44·5
175	13·13	172·6	12·73	162·2	10·49	110·1	9·98	99·7	9·45	89·3	8·73	76·2	8·27	68·4	7·89	62·3	6·59	43·4
180	12·96	168·0	12·56	157·8	10·35	107·2	9·85	97·1	9·32	87·0	8·62	74·3	8·17	66·7	7·79	60·6	6·51	42·4
185	12·79	163·6	12·40	153·7	10·22	104·5	9·73	94·6	9·21	84·8	8·51	72·4	8·06	65·1	7·69	59·1	6·44	41·4
190	12·62	159·4	12·24	149·8	10·09	101·9	9·60	92·3	9·09	82·7	8·41	70·7	7·97	63·5	7·60	57·7	6·36	40·5
195	12·47	155·5	12·09	146·1	9·97	99·4	9·49	90·1	8·98	80·7	8·31	69·0	7·87	62·0	7·51	56·4	6·29	39·6
200	12·32	151·8	11·94	142·6	9·85	97·1	9·38	88·0	8·88	78·9	8·21	67·5	7·79	60·6	7·43	55·2	6·23	38·8
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{13}{16}$ inch thick.

TABLE No. 243.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	14·00	196·0	13·57	184·1	11·17	124·7	10·62	112·9	10·05	101·0	9·28	86·1	8·79	77·2	8·37	70·1	6·98	48·7
170	13·80	190·4	13·37	178·9	11·01	121·2	10·47	109·7	9·91	98·2	9·15	83·8	8·67	75·1	8·26	68·2	6·89	47·5
175	13·60	185·2	13·19	174·0	10·86	118·0	10·33	106·8	9·77	95·6	9·03	81·6	8·55	73·2	8·15	66·4	6·80	46·3
180	13·42	180·2	13·01	169·3	10·71	114·8	10·19	104·0	9·65	93·1	8·91	79·5	8·44	71·3	8·05	64·8	6·72	45·2
185	13·24	175·5	12·84	164·9	10·58	111·9	10·06	101·3	9·52	90·7	8·80	77·5	8·34	69·5	7·95	63·2	6·64	44·1
190	13·07	171·0	12·67	160·7	10·44	109·1	9·94	98·8	9·40	88·5	8·69	75·6	8·24	67·8	7·85	61·7	6·56	43·1
195	12·91	166·8	12·52	156·7	10·32	106·5	9·82	96·4	9·29	86·4	8·59	73·8	8·14	66·3	7·76	60·2	6·49	42·1
200	12·76	162·8	12·37	153·0	10·19	104·0	9·70	94·2	9·18	84·4	8·49	72·1	8·05	64·8	7·67	58·9	6·42	41·2
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{27}{32}$ inch thick.

TABLE No. 244.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	14·48	209·8	14·04	197·1	11·55	133·4	10·98	120·6	10·39	107·9	9·59	92·0	9·08	82·4	8·65	74·8	7·20	51·8
170	14·27	203·8	13·83	191·5	11·38	129·6	10·83	117·3	10·24	104·9	9·46	89·4	8·95	80·2	8·53	72·7	7·10	50·5
175	14·08	198·2	13·64	186·2	11·23	126·1	10·68	114·1	10·10	102·1	9·33	87·0	8·83	78·0	8·41	70·8	7·01	49·2
180	13·96	194·8	13·46	181·2	11·08	122·8	10·54	111·1	9·97	99·4	9·21	84·8	8·72	76·0	8·31	69·0	6·93	48·0
185	13·70	187·8	13·28	176·4	10·93	119·6	10·40	108·2	9·84	96·9	9·09	82·7	8·61	74·1	8·20	67·3	6·85	46·9
190	13·53	183·0	13·11	171·9	10·80	116·6	10·27	105·5	9·72	94·5	8·98	80·6	8·50	72·3	8·10	65·7	6·77	45·8
195	13·36	178·5	12·95	167·7	10·66	113·8	10·15	103·0	9·60	92·2	8·87	78·7	8·40	70·6	8·01	64·2	6·69	44·8
200	13·19	174·2	12·79	163·6	10·54	111·1	10·03	100·6	9·49	90·1	8·77	76·9	8·31	69·0	7·92	62·7	6·62	43·8
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{7}{8}$ inch thick.

TABLE No. 245.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq.ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	14·97	224·1	14·51	210·5	11·93	142·3	11·34	128·7	10·72	115·0	9·90	98·0	9·37	87·8	8·92	79·6	7·42	55·0
170	14·75	217·7	14·30	204·5	11·76	138·3	11·18	125·1	10·57	111·8	9·76	95·3	9·24	85·4	8·80	77·4	7·32	53·6
175	14·55	211·7	14·10	198·8	11·60	134·5	11·03	121·7	10·43	108·8	9·63	92·7	9·11	83·1	8·68	75·4	7·23	52·2
180	14·35	206·0	13·91	193·5	11·44	131·0	10·88	118·5	10·29	106·0	9·50	90·3	9·00	81·0	8·57	73·5	7·14	51·0
185	14·16	200·5	13·72	188·4	11·29	127·6	10·74	115·4	10·16	103·2	9·38	88·0	8·88	78·9	8·46	71·6	7·05	49·7
190	13·98	195·4	13·55	183·6	11·15	124·4	10·61	112·5	10·03	100·7	9·27	85·9	8·77	77·0	8·36	69·9	6·97	48·6
195	13·80	190·6	13·38	179·0	11·01	121·3	10·48	109·8	9·91	98·3	9·15	83·8	8·67	75·2	8·26	68·3	6·89	47·5
200	13·63	186·0	13·22	174·7	10·88	118·5	10·35	107·2	9·79	96·0	9·05	81·9	8·57	73·5	8·17	66·7	6·82	46·5
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{29}{32}$ inch thick.

TABLE NO. 246.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	15·45	238·9	14·98	224·4	12·31	151·6	11·70	137·0	11·06	122·4	10·21	104·2	9·66	93·3	9·2	84·6	7·64	58·4
170	15·23	232·1	14·76	217·9	12·13	147·3	11·54	133·1	10·91	119·0	10·07	101·3	9·52	90·7	9·07	82·3	7·54	56·8
175	15·02	225·6	14·55	211·9	11·97	143·2	11·38	129·5	10·76	115·8	9·93	98·6	9·40	88·3	8·95	80·1	7·44	55·4
180	14·81	219·5	14·36	206·2	11·81	139·4	11·23	126·1	10·62	112·7	9·80	96·0	9·27	86·0	8·83	78·0	7·35	54·0
185	14·62	213·7	14·17	200·7	11·65	135·8	11·08	122·8	10·48	109·8	9·67	93·6	9·16	83·9	8·72	76·1	7·26	52·7
190	14·43	208·3	13·98	195·6	11·50	132·4	10·94	119·8	10·35	107·1	9·55	91·3	9·04	81·8	8·61	74·2	7·17	51·5
195	14·25	203·1	13·81	190·8	11·36	129·2	10·81	116·8	10·22	104·5	9·44	89·1	8·94	79·9	8·51	72·5	7·09	50·3
200	14·07	198·2	13·64	186·1	11·23	126·1	10·68	114·1	10·10	102·1	9·33	87·0	8·83	78·0	8·41	70·8	7·01	49·2
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{15}{16}$ inch thick.

TABLE No. 247.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	15·94	254·2	15·45	238·7	12·69	161·1	12·06	145·6	11·40	130·1	10·52	110·7	9·95	99·0	9·47	89·7	7·86	61·8
170	15·71	246·9	15·22	231·8	12·51	156·5	11·89	141·5	11·24	126·4	10·37	107·6	9·81	96·3	9 34	87·3	7·76	60·2
175	15·49	240·0	15·01	225·4	12·34	152·2	11·73	137·6	11·09	123·0	10·23	104·7	9·68	93·7	9·22	84·9	7·66	58·6
180	15·28	233·5	14·81	219·3	12·17	148·2	11·57	134·0	10·94	119·7	10·10	102·0	9·55	91·3	9·10	82·8	7·56	57·2
185	15·08	227·4	14·61	213·5	12·01	144·3	11·42	130·5	10·80	116·7	9·97	99·4	9·43	89·0	8·98	80·7	7·47	55·8
190	14·88	221·5	14·42	208·1	11·86	140·7	11·28	127·2	10·66	113·7	9·84	96·9	9·31	86·8	8·87	78·7	7·38	54·5
195	14·69	216·0	14·24	202·9	11·71	137·2	11·14	124·1	10·53	111·0	9·72	94·6	9·20	84·7	8·76	76·8	7·29	53·2
200	14·51	210·8	14·07	198·0	11·57	134·0	11·00	121·0	10·41	108·4	9·61	92·4	9·10	82·8	8·66	75·1	7·21	52·0
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $\frac{31}{32}$ inch thick.

TABLE No. 248.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	16·43	270·0	15·92	253·8	13·07	171·0	12·43	154·5	11·74	138·0	10·83	117·3	10·24	105·0	9·75	95·1	8·08	65·4
170	16·19	262·2	15·69	246·2	12·89	166·1	12·25	150·1	11·58	134·1	10·68	114·0	10·10	102·0	9·61	92·4	7·97	63·6
175	15·96	254·9	15·47	239·3	12·71	161·5	12·08	146·0	11·42	130·4	10·53	111·0	9·96	99·3	9·48	90·0	7·87	62·0
180	15·74	248·0	15·26	232·8	12·54	157·2	11·92	142·1	11·27	127·0	10·39	108·0	9·83	96·7	9·36	87·6	7·77	60·4
185	15·53	241·4	15·05	226·7	12·37	153·1	11·76	138·4	11·12	123·7	10·26	105·3	9·71	94·2	9·24	85·4	7·68	58·9
190	15·33	235·2	14·86	220·9	12·21	149·2	11·61	134·9	10·98	120·6	10·13	102·7	9·59	91·9	9·13	83·3	7·58	57·5
195	15·14	229·3	14·67	215·4	12·06	145·6	11·47	131·6	10·84	116·6	10·01	100·2	9·47	89·7	9·02	81·3	7·50	56·2
200	14·96	223·8	14·49	210·1	11·92	142·1	11·33	128·5	10·72	114·9	9·89	97·8	9·36	87·6	8·91	79·5	7·41	55·0
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate 1 inch thick.

TABLE No. 249.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	16·91	286·2	16·39	268·7	13·46	181·1	12·79	163·6	12·08	146·1	11·14	124·2	10·54	111·0	10·03	100·5	8·31	69·0
170	16·67	278·0	16·15	261·0	13·26	176·0	12·61	159·0	11·91	142·0	10·98	120·7	10·39	108·0	9·89	97·8	8·19	67·2
175	16·43	270·2	15·92	253·7	13·08	171·1	12·43	154·6	11·75	138·1	10·83	117·4	10·25	105·0	9·75	95·1	8·09	65·4
180	16·21	262·8	15·71	246·8	12·90	166·5	12·26	150·5	11·59	134·4	10·69	114·3	10·11	102·3	9·62	92·7	7·98	63·8
185	15·99	255·9	15·50	240·3	12·73	162·2	12·10	146·5	11·44	130·9	10·55	111·4	9·98	99·7	9·50	90·3	7·89	62·2
190	15·79	249·3	15·30	234·1	12·57	158·1	11·95	142·8	11·30	127·6	10·42	108·6	9·86	97·2	9·38	88·1	7·79	60·7
195	15·59	243·1	15·11	228·3	12·41	154·2	11·80	139·3	11·16	124·5	10·29	106·0	9·74	94·9	9·27	86·0	7·70	59·3
200	15·40	237·2	14·92	222·7	12·26	150·5	11·66	136·0	11·02	121·6	10·17	103·5	9·62	92·7	9·16	84·0	7·61	58·0
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{1}{32}$ inch thick.

TABLE No. 250.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		*I	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	17·40	302·9	16·86	284·4	13·84	191·6	13·15	173·0	12·43	154·4	11·45	131·2	10·83	117·3	10·30	106·2	8·53	72·8
170	17·15	294·2	16·62	276·2	13·64	186·1	12·96	168·1	12·25	150·1	11·29	127·5	10·68	114·0	10·16	103·2	8·41	70·8
175	16·91	286·0	16·38	268·5	13·45	181·0	12·78	163·5	12·08	146·0	11·14	124·1	10·53	111·0	10·02	100·5	8·30	69·0
180	16·68	278·2	16·16	261·2	13·27	176·1	12·61	159·1	11·92	142·1	10·99	120·8	10·39	108·0	9·89	97·8	8·20	67·2
185	16·45	270·8	15·94	254·3	13·09	171·5	12·45	154·9	11·76	138·4	10·85	117·7	10·26	105·3	9·76	95·3	8·10	65·6
190	16·24	263·8	15·74	247·7	12·93	167·1	12·29	151·0	11·61	134·9	10·71	114·7	10·13	102·7	9·64	93·0	8·00	64·0
195	16·04	257·2	15·54	241·5	12·77	163·0	12·13	147·3	11·47	131·6	10·58	112·0	10·01	100·2	9·53	90·8	7·90	62·5
200	15·84	251·0	15·35	235·6	12·61	159·1	11·99	143·8	11·33	128·5	10·45	109·3	9·89	97·8	9·41	88·6	7·81	61·1
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plates $1\frac{1}{16}$ inch thick.

TABLE No. 251.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq.ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	17·89	320·1	17·33	300·5	14·22	202·3	13·51	182·7	12·77	163·0	11·77	138·5	11·12	123·8	10·58	112·0	8·75	76·6
170	17·63	310·9	17·08	291·8	14·02	196·5	13·32	177·5	12·58	158·4	11·60	134·6	10·97	120·3	10·43	108·9	8·63	74·6
175	17·38	302·2	16·84	283·7	13·82	191·1	13·13	172·6	12·41	154·1	11·44	130·9	10·82	117·0	10·29	105·9	8·52	72·6
180	17·14	294·0	16·61	276·0	13·63	186·0	12·96	168·0	12·24	150·0	11·29	127·5	10·67	114·0	10·15	103·2	8·41	70·8
185	16·91	286·2	16·39	268·7	13·45	181·1	12·79	163·6	12·08	146·1	11·14	124·2	10·54	111·0	10·02	100·5	8·31	69·0
190	16·69	278·8	16·18	261·7	13·28	176·5	12·62	159·4	11·93	142·4	11·00	121·0	10·40	108·3	9·90	98·0	8·21	67·3
195	16·48	271·8	15·97	255·2	13·12	172·1	12·47	155·5	11·78	138·9	10·87	118·1	10·28	105·6	9·78	95·7	8·11	65·8
200	16·28	265·2	15·78	249·0	12·96	168·0	12·32	151·8	11·64	135·6	10·74	115·3	10·15	103·2	9·66	93·4	8·02	64·3
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{3}{32}$ inch thick.

TABLE No. 252.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq.ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	18·38	337·8	17·80	317·1	14·61	213·4	13·88	192·6	13·11	171·9	12·08	146·0	11·42	130·4	10·86	118·0	8·98	80·6
170	18·11	328·1	17·55	307·9	14·39	207·3	13·68	187·1	12·92	167·0	11·91	141·8	11·26	126·7	10·71	114·7	8·85	78·4
175	17·85	318·9	17·30	299·3	14·19	201·5	13·49	182·0	12·74	162·4	11·74	138·0	11·10	123·3	10·56	111·6	8·74	76·4
180	17·61	310·2	17·06	291·2	14·00	196·0	13·30	177·1	12·57	158·1	11·59	134·3	10·95	120·0	10·42	108·6	8·62	74·4
185	17·37	302·0	16·83	283·5	13·82	191·0	13·13	172·5	12·41	154·0	11·44	130·8	10·81	117·0	10·29	105·9	8·52	72·6
190	17·15	294·2	16·62	276·1	13·64	186·1	12·96	168·1	12·25	150·1	11·29	127·5	10·68	114·0	10·16	103·2	8·41	70·8
195	16·93	286·8	16·41	269·2	13·47	181·5	12·80	163·9	12·10	146·4	11·15	124·4	10·55	111·3	10·03	100·7	8·31	69·1
200	16·72	279·8	16·20	262·6	13·30	177·1	12·65	160·0	11·95	142·9	11·02	121·5	10·42	108·6	9·92	98·4	8·22	67·6
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Iron Plate $1\frac{1}{8}$ inch thick.

TABLE No. 253.

Pressure per sq. in.	A*		B*		C*		D*		E*		F*		G*		H*		I*	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	i. s.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	18·87	356·0	18·28	334·1	14·99	224·7	14·24	202·9	13·45	181·0	12·39	153·6	11·71	137·2	11·14	124·1	9·20	84·7
170	18·59	345·7	18·01	324·5	14·77	218·3	14·04	197·1	13·26	175·8	12·22	149·3	11·55	133·4	10·98	120·6	9·08	82·4
175	18·33	336·0	17·76	315·4	14·57	212·2	13·84	191·6	13·07	171·0	12·05	145·2	11·39	129·7	10·83	117·3	8·95	80·2
180	18·08	326·8	17·51	306·8	14·37	206·5	13·65	186·5	12·90	166·4	11·89	141·3	11·24	126·3	10·69	114·3	8·84	78·2
185	17·83	318·2	17·28	298·7	14·18	201·1	13·47	181·6	12·73	162·1	11·73	137·7	11·09	123·0	10·55	111·3	8·73	76·2
190	17·60	310·0	17·05	291·0	14·00	196·0	13·30	177·0	12·57	158·0	11·58	134·2	10·95	120·0	10·42	108·6	8·62	74·4
195	17·38	302·2	16·84	283·6	13·82	191·1	13·13	172·6	12·41	154·1	11·44	130·9	10·82	117·0	10·29	105·9	8·52	72·6
200	17·17	294·8	16·63	276·7	13·65	186·5	12·97	168·4	12·26	150·4	11·30	127·8	10·69	114·3	10·17	103·4	8·42	70·9
	A*		B*		C*		D*		E*		F*		G*		H*		I*	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 64 and following.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on Iron Stay, 5000 lbs. per square inch of net section.* TABLE No. 254.

Pressure per square inch.	Area 0·1963 sq. inch.	Area 0·2485 sq. inch.	Area 0·3068 sq. inch.	Area 0·3712 sq. inch.	Area 0·4417 sq. inch.	Area 0·5184 sq. inch.	Area 0·6013 sq. inch.	Area 0·6902 sq. inch.	Area 0·7854 sq. inch.	Area 0·8866 sq. inch.	Area 0·9940 sq. inch.	Area 1·1075 sq. inch.	Area 1·2272 sq. inch.	Area 1·3530 sq. inch.	Area 1·4849 sq. inch.
	Diam. ½ inch.	Diam. 9/16 inch.	Diam. ⅝ inch.	Diam. 1 1/16 inch.	Diam. ¾ inch.	Diam. 1 3/16 inch.	Diam. ⅞ inch.	Diam. 1 5/16 inch.	Diam. 1 inch.	Diam. 1 1/16 inch.	Diam. 1⅛ inch.	Diam. 1 3/16 inch.	Diam. 1¼ inch.	Diam. 1 5/16 inch.	Diam. 1⅜ inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	...	...	...	...	13·3	15·7	18·2	20·9	23·8	26·8	30·1	33·5	37·1	41·0	44·9
170	...	...	...	...	12·9	15·2	17·6	20·3	23·1	26·0	29·2	32·5	36·0	39·7	43·6
175	...	...	...	...	12·6	14·8	17·1	19·7	22·4	25·3	28·4	31·6	35·0	38·6	42·4
180	...	...	...	...	12·2	14·4	16·7	19·1	21·8	24·6	27·6	30·7	34·0	37·5	41·2
185	...	...	...	...	...	14·0	16·2	18·6	21·2	23·9	26·8	29·9	33·1	36·5	40·1
190	...	...	...	...	...	13·6	15·8	18·1	20·6	23·3	26·1	29·1	32·2	35·6	39·0
195	...	...	...	...	...	13·2	15·4	17·6	20·1	22·7	25·4	28·3	31·4	34·6	38·0
200	...	...	...	...	...	12·9	15·0	17·2	19·6	22·1	24·8	27·6	30·6	33·8	37·1

* 5000 lbs. per square inch of net section is the greatest working stress to which iron stays, which have been welded or worked in the fire, should be subjected. See Notes page 126.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on Iron Stay, 5000 lbs. per square inch of net section.* TABLE No. 255.

Pressure per square inch.	Area 1·6230 sq. inch.	Area 1·7671 sq. inch.	Area 1·9175 sq. inch.	Area 2·0739 sq. ins.	Area 2·2365 sq. ins.	Area 2·4053 sq. ins.	Area 2·5802 sq. ins.	Area 2·7612 sq. ins.	Area 2·9483 sq. ins.	Area 3·1416 sq. ins.	Area 3·3410 sq. ins.	Area 3·5466 sq. ins.	Area 3·7583 sq. ins.	Area 3·9761 sq. ins.	Area 4·200 sq. ins.
	Diam. $1\frac{7}{16}$ inch.	Diam. $1\frac{1}{2}$ inch.	Diam. $1\frac{9}{16}$ inch.	Diam. $1\frac{5}{8}$ inch.	Diam. $1\frac{11}{16}$ inch.	Diam. $1\frac{3}{4}$ inch.	Diam. $1\frac{13}{16}$ inch.	Diam. $1\frac{7}{8}$ inch.	Diam. $1\frac{15}{16}$ inch.	Diam. 2 inches.	Diam. $2\frac{1}{16}$ inches.	Diam. $2\frac{1}{8}$ inches.	Diam. $2\frac{3}{16}$ inches.	Diam. $2\frac{1}{4}$ inches.	Diam. $2\frac{5}{16}$ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	49·1	53·5	58·1	62·8	67·7	72·8	78·1	83·6	89·3	95·2	101·2	107·4	113·8	120·4	127·2
170	47·7	51·9	56·3	60·9	65·7	70·7	75·8	81·2	86·7	92·4	98·2	104·3	110·5	116·9	123·5
175	46·3	50·4	54·7	59·2	63·9	68·7	73·7	78·8	84·2	89·7	95·4	101·3	107·3	113·6	120·0
180	45·0	49·0	53·2	57·6	62·1	66·8	71·6	76·7	81·8	87·2	92·8	98·5	104·3	110·4	116·6
185	43·8	47·7	51·8	56·0	60·4	65·0	69·7	74·6	79·6	84·9	90·2	95·8	101·5	107·4	113·5
190	42·7	46·5	50·4	54·5	58·8	63·2	67·9	72·6	77·5	82·6	87·9	93·3	98·9	104·6	110·5
195	41·6	45·3	49·1	53·1	57·3	61·6	66·1	70·8	75·5	80·5	85·6	90·9	96·3	101·9	107·6
200	40·5	44·1	47·9	51·8	55·9	60·1	64·5	69·0	73·7	78·5	83·5	88·6	93·9	99·4	105·0

* 5000 lbs. per square inch of net section is the greatest working stress to which iron stays, which have been welded or worked in the fire, should be subjected. See Notes page 126.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on Iron Stay, 5000 lbs. per square inch of net section.* TABLE No. 256.

Pressure per square inch.	Area 4·4301 sq. ins.	Area 4·6664 sq. ins.	Area 4·9087 sq. ins.	Area 5·1572 sq. ins.	Area 5·4119 sq. ins.	Area 5·6727 sq. ins.	Area 5·9396 sq. ins.	Area 6·2126 sq. ins.	Area 6·4918 sq. ins.	Area 6·7771 sq. ins.	Area 7·0686 sq. ins.	Area 7·3662 sq. ins.	Area 7·6699 sq. ins.	Area 7·9798 sq. ins.	Area 8·2958 sq. ins.
	Diam. 2⅜ inches.	Diam. 2 7/16 inches.	Diam. 2½ inches.	Diam. 2 9/16 inches.	Diam. 2⅝ inches.	Diam. 2 11/16 inches.	Diam. 2¾ inches.	Diam. 2 13/16 inches.	Diam. 2⅞ inches.	Diam. 2 15/16 inches.	Diam. 3 inches.	Diam. 3 1/16 inches.	Diam. 3⅛ inches.	Diam. 3 3/16 inches.	Diam. 3¼ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	134·2	141·4	148·7	156·2	163·9	171·9	179·9	188·2	196·7	205·3	214·2	223·2	232·4	241·8	251·3
170	130·2	137·2	144·3	151·6	159·1	166·8	174·6	182·7	190·9	199·3	207·9	216·6	225·5	234·7	243·9
175	126·5	133·3	140·2	147·3	154·6	162·0	169·7	177·5	185·4	193·6	201·9	210·4	219·1	227·9	237·0
180	123·0	129·6	136·3	143·2	150·3	157·5	164·9	172·5	180·3	188·2	196·3	204·6	213·0	221·6	230·4
185	119·7	126·1	132·6	139·3	146·2	153·3	160·5	167·9	175·4	183·1	191·0	199·0	207·2	215·6	224·2
190	116·5	122·8	129·1	135·7	142·4	149·2	156·3	163·4	170·8	178·3	186·0	193·8	201·8	209·9	218·3
195	113·5	119·6	125·8	132·2	138·7	145·4	152·2	159·2	166·4	173·7	181·2	188·8	196·6	204·6	212·7
200	110·7	116·6	122·7	128·9	135·2	141·8	148·4	155·3	162·2	169·4	176·7	184·1	191·7	199·4	207·3

* 5000 lbs. per square inch of net section is the greatest working stress to which iron stays, which have been welded or worked in the fire, should be subjected. See Notes page 126.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.* TABLE NO. 257.

Pressure per square inch.	Area 0·1963 sq. inch. Diam. ½ inch.	Area 0·2485 sq. inch. Diam. 9/16 inch.	Area 0·3068 sq. inch. Diam. ⅝ inch.	Area 0·3712 sq. inch. Diam. 11/16 inch.	Area 0·4417 sq. inch. Diam. ¾ inch.	Area 0·5184 sq. inch. Diam. 13/16 inch.	Area 0·6013 sq. inch. Diam. ⅞ inch.	Area 0·6902 sq. inch. Diam. 15/16 inch.	Area 0·7854 sq. inch. Diam. 1 inch.	Area 0·8866 sq. inch. Diam. 1 1/16 inch.	Area 0·9940 sq. inch. Diam. 1⅛ inch.	Area 1·1075 sq. inch. Diam. 1 3/16 inch.	Area 1·2272 sq. inch. Diam. 1¼ inch.	Area 1·3530 sq. inch. Diam. 1 5/16 inch.	Area 1·4849 sq. inch. Diam. 1⅜ inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	...	...	13·0	15·7	18·7	21·9	25·5	29·2	33·3	37·6	42·1	46·9	52·0	57·4	62·9
170	...	...	12·6	15·2	18·1	21·3	24·7	28·4	32·3	36·5	40·9	45·6	50·5	55·7	61·1
175	...	...	12·2	14·8	17·6	20·7	24·0	27·6	31·4	35·4	39·7	44·2	49·0	54·1	59·3
180	...	...	...	14·4	17·1	20·1	23·3	26·8	30·5	34·4	38·6	43·0	47·7	52·6	57·7
185	...	...	...	14·0	16·7	19·6	22·7	26·1	29·7	33·5	37·6	41·9	46·4	51·1	56·1
190	...	...	...	13·6	16·2	19·0	22·1	25·4	28·9	32·6	36·6	40·8	45·2	49·8	54·7
195	...	...	...	13·3	15·8	18·6	21·5	24·7	28·1	31·8	35·6	39·7	44·0	48·5	53·3
200	...	...	...	12·9	15·4	18·1	21·0	24·1	27·4	31·0	34·7	38·7	42·9	47·3	51·9

* 7000 lbs. per square inch of net section is the greatest working stress to which *solid* iron screwed stays, which have *not* been welded or worked in the fire, should be subjected. See Notes page 132.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.*

TABLE No. 258.

Pressure per square inch.	Area 1·6230 sq. inch.	Area 1·7671 sq. inch.	Area 1·9175 sq. inch.	Area 2·0739 sq. ins.	Area 2·2365 sq. ins.	Area 2·4053 sq. ins.	Area 2·5802 sq. ins.	Area 2·7612 sq. ins.	Area 2·9483 sq. ins.	Area 3·1416 sq. ins.	Area 3·3410 sq. ins.	Area 3·5466 sq. ins.	Area 3·7583 sq. ins.	Area 3·9761 sq. ins.	Area 4·200 sq. ins.
	Diam. 1 7/16 inch.	Diam. 1 1/2 inch.	Diam. 1 9/16 inch.	Diam. 1 5/8 inch.	Diam. 1 11/16 inch.	Diam. 1 3/4 inch.	Diam. 1 13/16 inch.	Diam. 1 7/8 inch.	Diam. 1 15/16 inch.	Diam. 2 inches.	Diam. 2 1/16 inches.	Diam. 2 1/8 inches.	Diam. 2 3/16 inches.	Diam. 2 1/4 inches.	Diam. 2 5/16 inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	68·8	74·9	81·3	87·9	94·8	102·0	109·4	117·1	125·0	133·2	141·7	150·4	159·4	168·6	178·1
170	66·8	72·7	78·9	85·3	92·0	99·0	106·2	113·6	121·4	129·3	137·5	146·0	154·7	163·7	172·9
175	64·9	70·6	76·6	82·9	89·4	96·2	103·2	110·4	117·9	125·6	133·6	141·8	150·3	159·0	168·0
180	63·1	68·7	74·5	80·6	86·9	93·5	100·3	107·3	114·6	122·1	129·9	137·9	146·1	154·6	163·3
185	61·4	66·8	72·5	78·4	84·6	91·0	97·6	104·4	111·5	118·8	126·4	134·1	142·2	150·4	158·9
190	59·7	65·1	70·6	76·4	82·3	88·6	95·0	101·7	108·6	115·7	123·0	130·6	138·4	146·4	154·7
195	58·2	63·4	68·8	74·4	80·2	86·3	92·6	99·1	105·8	112·7	119·9	127·3	134·9	142·7	150·7
200	56·8	61·8	67·1	72·5	78·2	84·1	90·3	96·6	103·1	109·9	116·9	124·1	131·5	139·1	147·0

* 7000 lbs. per square inch of net section is the greatest working stress to which *solid* iron screwed stays, which have *not* been welded or worked in the fire, should be subjected. See Notes page 132.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on *Solid* Iron Screwed Stays, which have *not* been welded or worked in the fire, 7000 lbs. per square inch of net section.* TABLE No. 259.

Pressure per square inch.	Area 4·4301 sq. ins.	Area 4·6664 sq. ins.	Area 4·9087 sq. ins.	Area 5·1572 sq. ins.	Area 5·4119 sq. ins.	Area 5·6727 sq. ins.	Area 5·9396 sq. ins.	Area 6·2126 sq. ins.	Area 6·4918 sq. ins.	Area 6·7771 sq. ins.	Area 7·0686 sq. ins.	Area 7·3662 sq. ins.	Area 7·6699 sq. ins.	Area 7·9798 sq. ins.	Area 8·2958 sq. ins.
	Diam. 2⅜ inches.	Diam. 2 7/16 inches.	Diam. 2½ inches.	Diam. 2 9/16 inches.	Diam. 2⅝ inches.	Diam. 2 11/16 inches.	Diam. 2¾ inches.	Diam. 2 13/16 inches.	Diam. 2⅞ inches.	Diam. 2 15/16 inches.	Diam. 3 inches.	Diam. 3 1/16 inches.	Diam. 3⅛ inches.	Diam. 3 3/16 inches.	Diam. 3¼ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	187·9	197·9	208·2	218·7	229·5	240·6	251·9	263·5	275·4	287·5	299·8	312·5	325·3	338·5	351·9
170	182·4	192·1	202·1	212·3	222·8	233·5	244·5	255·8	267·3	279·0	291·0	303·3	315·8	328·5	341·5
175	177·2	186·6	196·3	206·2	216·4	226·9	237·5	248·5	259·6	271·0	282·7	294·6	306·7	319·1	331·8
180	172·2	181·4	190·8	200·5	210·4	220·6	230·9	241·6	252·4	263·5	274·8	286·4	298·2	310·3	322·6
185	167·6	176·5	185·7	195·1	204·7	214·6	224·7	235·0	245·6	256·4	267·4	278·7	290·2	301·9	313·8
190	163·2	171·9	180·8	190·0	199·3	208·9	218·8	228·8	239·1	249·6	260·4	271·3	282·5	293·9	305·6
195	159·0	167·5	176·2	185·1	194·2	203·6	213·2	223·0	233·0	243·2	253·7	264·4	275·3	286·4	297·7
200	155·0	163·3	171·8	180·5	189·4	198·5	207·8	217·4	227·2	237·1	247·4	257·8	268·4	279·2	290·3

* 7000 lbs. per square inch of net section is the greatest working stress to which *solid* iron screwed stays, which have *not* been welded or worked in the fire, should be subjected. See Notes page 132.

IRON GIRDERS $\frac{1}{2}$ INCH THICK. TABLE No. 260.

Pressure per sq. in.	Depths of Girders in inches.								
	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
lbs. 165	...	...	...	...	...	...	...	...	511
170	...	...	...	...	...	...	...	...	...
175	...	...	...	...	...	...	...	...	...
180	...	...	...	...	...	...	...	...	...
185	...	...	...	...	...	...	...	...	...
190	...	...	...	...	...	...	...	...	...
195	...	...	...	...	...	...	...	...	...
200	...	...	...	...	...	...	...	...	...

IRON GIRDERS $\frac{5}{8}$ INCH THICK. TABLE No. 261.

Pressure per sq. in.	Depths of Girders in inches.								
	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼
lbs. 165	...	...	...	...	...	556	639	727	821
170	...	...	...	...	...	540	620	705	796
175	...	...	...	...	...	525	602	685	774
180	...	...	...	...	...	510	585	666	752
185	...	...	...	...	...	...	570	648	732
190	...	...	...	...	...	...	555	631	712
195	...	...	...	...	...	...	540	615	694
200	...	...	...	...	...	...	527	600	677

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches. See Notes on pages 138 and 139.

IRON GIRDERS $\frac{3}{4}$ INCH THICK. TABLE No. 262.

Pressure per sq. in.	Depths of Girders in inches.								
	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾
lbs.									
165	..	...	576	668	767	872	985	1104	1230
170	...	...	559	648	744	847	956	1072	1194
175	...	...	543	630	723	822	928	1041	1160
180	...	...	528	612	703	800	903	1012	1128
185	...	...	513	595	684	778	878	985	1097
190	...	...	500	580	666	757	855	959	1068
195	...	...	...	565	649	738	833	934	1041
200	...	...	...	551	632	720	812	911	1015

IRON GIRDERS $\frac{7}{8}$ INCH THICK. TABLE No. 263.

Pressure per sq. in.	Depths of Girders in inches.								
	3½	3¾	4	4¼	4½	4¾	5	5¼	5½
lbs.									
165	779	894	1018	1149	1288	1435	1590	1753	1925
170	756	868	988	1115	1250	1393	1544	1702	1868
175	735	843	960	1083	1215	1353	1500	1653	1815
180	714	820	933	1053	1181	1316	1458	1607	1764
185	695	798	908	1025	1149	1280	1418	1564	1716
190	676	777	884	998	1119	1246	1381	1523	1671
195	659	757	861	972	1090	1214	1346	1484	1628
200	643	738	840	948	1063	1184	1312	1447	1588

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches. See Notes on pages 138 and 139.

IRON GIRDERS 1 INCH THICK. TABLE No. 264.

Pressure per sq. in.	Depths of Girders in inches.								
	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼
lbs.									
165	1313	1472	1640	1818	2004	2200	2404	2618	2840
170	1275	1429	1592	1764	1945	2135	2333	2541	2757
175	1238	1388	1547	1714	1890	2074	2267	2468	2678
180	1204	1350	1504	1666	1837	2016	2204	2400	2604
185	1171	1313	1463	1621	1787	1962	2144	2335	2533
190	1140	1278	1425	1578	1740	1910	2088	2273	2467
195	1111	1246	1388	1538	1696	1861	2034	2215	2403
200	1083	1215	1353	1500	1653	1815	1983	2160	2343

IRON GIRDERS $1\frac{1}{8}$ INCH THICK. TABLE No. 265.

Pressure per sq. in.	Depths of Girders in inches.								
	5	5¼	5½	5¾	6	6¼	6½	6¾	7
lbs.									
165	2045	2255	2475	2705	2945	3196	3456	3727	4009
170	1985	2188	2402	2625	2858	3102	3355	3618	3891
175	1928	2126	2333	2550	2777	3013	3259	3514	3780
180	1875	2067	2268	2479	2700	2929	3168	3417	3675
185	1824	2011	2207	2412	2627	2850	3083	3324	3575
190	1776	1958	2149	2349	2557	2775	3001	3237	3481
195	1730	1908	2094	2288	2492	2704	2925	3154	3392
200	1687	1860	2041	2231	2430	2636	2851	3075	3307

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches. See Notes on pages 138 and 139.

IRON GIRDERS $1\frac{1}{4}$ INCH THICK. TABLE No. 266.

Pressure per sq. in.	Depths of Girders in inches.								
	5¾	6	6¼	6½	6¾	7	7¼	7½	7¾
lbs. 165	3005	3272	3551	3840	4142	4454	4778	5113	5460
170	2917	3176	3446	3727	4020	4323	4637	4963	5299
175	2833	3085	3348	3621	3905	4200	4505	4821	5148
180	2755	3000	3255	3520	3796	4083	4380	4687	5005
185	2680	2918	3167	3425	3694	3972	4261	4560	4869
190	2610	2842	3083	3335	3597	3868	4149	4440	4741
195	2543	2769	3004	3250	3504	3769	4043	4326	4620
200	2479	2700	2929	3168	3417	3675	3942	4218	4504

IRON GIRDERS $1\frac{3}{8}$ INCH THICK. TABLE No. 267.

Pressure per sq. in.	Depths of Girders in inches.								
	6½	6¾	7	7¼	7½	7¾	8	8¼	8½
lbs. 165	4225	4556	4900	5256	5625	6006	6400	6806	7225
170	4100	4422	4755	5101	5459	5829	6211	6606	7012
175	3983	4295	4620	4955	5303	5663	6034	6417	6812
180	3872	4176	4491	4818	5156	5505	5866	6239	6622
185	3768	4063	4370	4688	5016	5356	5708	6070	6443
190	3669	3956	4255	4564	4884	5215	5557	5910	6274
195	3575	3855	4146	4447	4759	5082	5415	5759	6113
200	3485	3758	4042	4336	4640	4955	5280	5615	5960

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches. See Notes on pages 138 and 139.

IRON GIRDERS $1\frac{1}{2}$ INCH THICK. TABLE No. 268.

Pressure per sq. in.	Depths of Girders in inches.								
	7¼	7½	7¾	8	8¼	8½	8¾	9	9¼
lbs.									
165	5734	6136	6552	6981	7425	7881	8352	8836	9334
170	5565	5955	6359	6776	7206	7650	8106	8576	9059
175	5406	5785	6177	6582	7000	7431	7875	8331	8800
180	5256	5625	6006	6400	6806	7225	7656	8100	8556
185	5114	5472	5843	6227	6622	7029	7449	7881	8325
190	4979	5328	5690	6063	6448	6844	7253	7673	8105
195	4851	5192	5544	5907	6282	6669	7067	7476	7898
200	4730	5062	5405	5760	6125	6502	6890	7290	7700

IRON GIRDERS $1\frac{5}{8}$ INCH THICK. TABLE No. 269.

Pressure per sq. in.	Depths of Girders in inches.								
	8	8¼	8½	8¾	9	9¼	9½	9¾	10
lbs.									
165	7563	8043	8538	9048	9572	10111	10665	11234	11818
170	7341	7807	8287	8782	9291	9814	10352	10904	11470
175	7131	7584	8050	8531	9025	9534	10056	10592	11142
180	6933	7373	7827	8294	8775	9269	9777	10298	10833
185	6745	7174	7615	8070	8537	9018	9512	10020	10540
190	6568	6985	7415	7857	8313	8781	9262	9756	10263
195	6400	6806	7225	7656	8100	8556	9025	9506	10000
200	6240	6636	7044	7464	7897	8342	8799	9268	9750

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches. See Notes on pages 138 and 139.

IRON GIRDERS $1\frac{3}{4}$ INCH THICK.

TABLE No. 270.

Pressure per sq. in.	Depths of Girders in inches.								
	8¾	9	9¼	9½	9¾	10	10¼	10½	10¾
lbs.									
165	9744	10309	10889	11486	12098	12727	13371	14031	14707
170	9457	10005	10569	11148	11743	12352	12978	13619	14275
175	9187	9720	10267	10830	11407	12000	12607	13230	13867
180	8932	9450	9982	10529	11090	11666	12257	12862	13482
185	8690	9194	9712	10244	10790	11351	11926	12514	13117
190	8462	8952	9456	9975	10506	11052	11612	12185	12772
195	8245	8723	9214	9719	10237	10769	11314	11873	12445
200	8039	8505	8984	9476	9981	10500	11031	11576	12134

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches. See Notes on pages 138 and 139.

FURNACES PLAIN CYLINDRICAL.

Iron Plates.

Pressures and Numerals for Lengths and Diameters.

Iron Plates $\frac{1}{4}$ inch thick. TABLE No. 271.									Iron Plates $\frac{9}{32}$ inch thick. TABLE No. 272.								
Pressure per sq. in.	Numerals.							Maximum Diam.*	Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N			A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.	lbs.								ins.
165	34·1	32·2	30·3	28·4	26·5	24·6	22·7	13·63	165	43·1	40·7	38·4	36·0	33·6	31·2	28·8	15·34
170	33·1	31·3	29·4	27·6	25·7	23·9	22·1	13·23	170	41·9	39·6	37·2	34·9	32·6	30·2	27·9	14·88
175	32·1	30·4	28·6	26·8	25·0	23·2	21·4	12·85	175	40·7	38·4	36·2	33·9	31·6	29·4	27·1	14·46
180	31·3	29·5	27·8	26·0	24·3	22·6	20·8	12·50	180	39·6	37·4	35·2	33·0	30·8	28·6	26·4	14·06
185	30·4	28·7	27·0	25·3	23·6	22·0	20·3	12·16	185	38·5	36·3	34·2	32·1	29·9	27·8	25·7	13·68
190	29·6	28·0	26·3	24·7	23·0	21·4	19·7	11·84	190	37·5	35·4	33·3	31·2	29·1	27·1	25·0	13·32
195	28·8	27·2	25·6	24·0	22·4	20·8	19·2	11·53	195	36·5	34·5	32·5	30·4	28·4	26·4	24·3	12·98
200	28·1	26·6	25·0	23·4	21·9	20·3	18·8	11·25	200	35·6	33·6	31·6	29·7	27·7	25·7	23·7	12·65

The length L should never exceed 10 feet and $\frac{N}{D}-1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*. See notes pages 170 to 173.

† When A1 is the distinguishing letter Table No. 284 may be used when the length does not exceed for $\frac{1}{4}$ inch, 1·5 feet and, for $\frac{9}{32}$ inch, 1·812 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D}-1=L$. $\frac{N}{L+1}=D$. $(L+1)\ D=N$.

FURNACES PLAIN CYLINDRICAL.

Iron Plates.

Pressures and Numerals for Lengths and Diameters.

Iron Plates $\frac{5}{16}$ inch thick. TABLE No. 273.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	53·3	50·3	47·3	44·4	41·4	38·5	35·5	17·04
170	51·7	48·8	46·0	43·1	40·2	37·3	34·5	16·54
175	50·2	47·4	44·6	41·9	39·1	36·3	33·5	16·07
180	48·8	46·1	43·4	40·7	38·0	35·3	32·6	15·62
185	47·5	44·9	42·2	39·6	37·0	34·3	31·7	15·20
190	46·3	43·7	41·1	38·5	36·0	33·4	30·8	14·80
195	45·1	42·6	40·1	37·6	35·1	32·6	30·0	14·42
200	43·9	41·5	39·1	36·6	34·2	31·7	29·3	14·06

Iron Plates $\frac{11}{32}$ inch thick. TABLE No. 274.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	64·5	60·9	57·3	53·7	50·1	46·5	43·0	18·75
170	62·6	59·1	55·6	52·1	48·7	45·2	41·7	18·19
175	60·8	57·4	54·0	50·6	47·3	43·9	40·5	17·67
180	59·1	55·8	52·5	49·2	46·0	42·7	39·4	17·18
185	57·5	54·3	51·1	47·9	44·7	41·5	38·3	16·72
190	56·0	52·9	49·8	46·6	43·5	40·4	37·3	16·28
195	54·5	51·5	48·5	45·4	42·4	39·4	36·4	15·86
200	53·2	50·2	47·3	44·3	41·4	38·4	35·4	15·46

The length L should never exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.* See notes pages 170 to 173.

† When A1 is the distinguishing letter Table No. 284 may be used when the length does not exceed for $\frac{5}{16}$ inch, 2·125 feet and, for $\frac{11}{32}$ inch, 2·437 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)D = N.$

FURNACES PLAIN CYLINDRICAL.

Iron Plates.

Pressures and Numerals for Lengths and Diameters.

Iron Plates $\frac{3}{8}$ inch thick. TABLE No. 275.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	76·7	72·4	68·2	63·9	59·7	55·4	51·1	20·45
170	74·4	70·3	66·2	62·0	57·9	53·8	49·6	19 85
175	72·3	68·3	64·3	60·3	56·3	52·2	48·2	19·28
180	70·3	66·4	62·5	58·6	54·7	50·8	46·9	18·75
185	68·4	64·6	60·8	57·0	53·2	49·4	45·6	18·24
190	66·6	62·9	59·2	55·5	51·8	48·1	44·4	17·76
195	64·9	61·3	57·7	54·1	50·5	46·9	43·3	17·30
200	63·3	59·8	56·3	52·7	49·2	45·7	42·2	16·87

Iron Plates $\frac{13}{32}$ inch thick. TABLE No. 276.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	90·0	85·0	80·0	75·0	70·0	65·0	60·0	22·15
170	87·4	82·5	77·7	72·8	68·0	63·1	58·2	21·50
175	84·9	80·2	75·4	70·7	66·0	61·3	56·6	20·89
180	82·5	77·9	73·4	68·8	64·2	59·6	55·0	20·31
185	80·3	75·8	71·4	66·9	62·4	58·0	53·5	19·76
190	78·2	73·8	69 5	65·1	60·8	56·5	52·1	19·24
195	76·2	71·9	67·7	63·5	59·2	55 0	50·8	18·75
200	74·3	70·1	66·0	61·9	57·8	53·6	49·5	18·28

The length L should never exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*. See notes, pages 170 to 173.

† When A1 is the distinguishing letter Table No. 284 may be used when the length does not exceed for $\frac{3}{8}$ inch, 2·75 feet and, for $\frac{13}{32}$ inch, 3·062 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\,D = N.$

FURNACES PLAIN CYLINDRICAL.

Iron Plates.

Pressures and Numerals for Lengths and Diameters.

Iron Plates $\frac{7}{16}$ inch thick. Table No. 277.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
165	104	98·6	92·8	87·0	81·2	75·4	69·6	23·56
170	101	95·7	90·1	84·4	78·8	73·2	67·6	23·16
175	98·4	93·0	87·5	82·0	76·6	71·1	65·6	22·50
180	95·7	90·4	85·1	79·8	74·4	69·1	63·8	21·87
185	93·1	87·9	82·8	77·6	72·4	67·3	62·1	21·28
190	90·7	85·6	80·6	75·6	70·5	65·5	60·4	20·72
195	88·3	83·4	78·5	73·6	68·7	63·8	58·9	20·19
200	86·1	81·3	76·6	71·8	67·0	62·2	57·4	19·68

Iron Plates $\frac{15}{32}$ inch thick. Table No. 278.

Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
165	120	113	107	99·9	93·2	86·6	79·9	25·56
170	116	110	103	96·9	90·5	84·0	77·6	24·81
175	113	107	100	94·2	87·9	81·6	75·3	24·10
180	110	104	97·7	91·6	85·4	79·3	73·2	23·43
185	107	101	95·0	89·1	83·1	77·2	71·3	22·80
190	104	98·3	92·5	86·7	81·0	75·2	69·4	22·20
195	101	95·8	90·1	84·5	78·9	73·2	67·6	21·63
200	98·9	93·4	87·9	82·4	76·9	71·4	65·9	21·09

The length L should never exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* **The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*. See notes, pages 170 to 173.**

† When A1 is the distinguishing letter Table No. 284 may be used when the length does not exceed for $\frac{7}{16}$ inch, 3·375 feet and, for $\frac{15}{32}$ inch, 3·687 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L$. $\frac{N}{L+1} = D$. $(L+1)\,D = N$.

FURNACES PLAIN CYLINDRICAL.

Iron Plates.

Pressures and Numerals for Lengths and Diameters.

Iron Plates $\frac{1}{2}$ inch thick. TABLE No. 279.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	136	129	121	114	106	98·5	90·9	27·27
170	132	125	118	110	103	95·6	88·2	26·47
175	129	121	114	107	100	92·9	85·7	25·71
180	125	118	111	104	97·2	90·3	83·3	25·00
185	122	115	108	101	94·6	87·8	81·1	24·32
190	118	112	105	98·7	92·1	85·5	78·9	23·68
195	115	109	103	96·2	89·7	83·3	76·9	23·07
200	113	106	100	93·8	87·5	81·3	75·0	22·50

Iron Plates $\frac{17}{32}$ inch thick. TABLE No. 280.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	154	145	137	128	120	111	103	28·97
170	149	141	133	125	116	108	99·6	28·12
175	145	137	129	121	113	105	96·8	27·32
180	141	133	125	118	110	102	94·1	26·56
185	137	130	122	114	107	99·2	91·5	25·84
190	134	126	119	111	104	96·6	89·1	25·16
195	130	123	116	109	101	94·1	86·8	24·51
200	127	120	113	106	98·8	91·7	84·7	23·90

The length L should never exceed 10 feet and $\frac{N}{D}-1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*. See notes, pages 170 to 173.

† When A1 is the distinguishing letter Table No. 284 may be used when the length does not exceed for $\frac{1}{2}$ inch, 4 feet and, for $\frac{17}{32}$ inch, 4·312 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D}-1=L.$ $\frac{N}{L+1}=D.$ $(L+1)D=N.$

FURNACES PLAIN CYLINDRICAL.

Iron Plates.

Pressures and Numerals for Lengths and Diameters.

Iron Plates $\frac{9}{16}$ inch thick. TABLE No. 281.

Pressure per sq. in.	Numerals. Al†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	173	163	153	144	134	125	115	30·68
170	168	158	149	140	130	121	112	29·77
175	163	154	145	136	127	118	108	28·92
180	158	149	141	132	123	114	105	28·12
185	154	145	137	128	120	111	103	27·36
190	150	142	133	125	117	108	99·9	26·64
195	146	138	130	122	114	105	97·4	25·96
200	142	134	127	119	111	103	94·9	25·31

Iron Plates $\frac{19}{32}$ inch thick. TABLE No. 282.

Pressure per sq. in.	Numerals. Al†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	192	182	171	160	150	139	128	32·38
170	187	176	166	156	145	135	124	31·43
175	181	171	161	151	141	131	121	30·53
180	176	166	157	147	137	127	118	29·68
185	172	162	152	143	133	124	114	28·88
190	167	158	148	139	130	121	111	28·12
195	163	154	145	136	127	118	108	27·40
200	159	150	141	132	123	115	106	26·71

The length L should nev. r exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*. See notes, pages 170 to 173.

† When A1 is the distinguishing letter Table No. 284 may be used when the length does not exceed for $\frac{9}{16}$ inch, 4·625 feet and, for $\frac{19}{32}$ inch, 4·937 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\,D = N.$

FURNACES PLAIN CYLINDRICAL.

Iron Plates.

Pressures and Numerals for Lengths and Diameters.

Iron Plates $\frac{5}{8}$ inch thick. TABLE No. 283.

Pressure per sq. in.	Numerals.							Maximum Diameter.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
165	213	201	189	178	166	154	142	34·09
170	207	195	184	172	161	149	138	33·08
175	201	190	179	167	156	145	134	32·14
180	195	184	174	163	152	141	130	31·25
185	190	179	169	158	148	137	127	30·40
190	185	175	164	154	144	134	123	29·60
195	180	170	160	150	140	130	120	28·84
200	176	166	156	146	137	127	117	28·12

The length L should never exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.* See notes, pages 170 to 173.

† When A1 is the distinguishing letter Table No. 284 may be used when the length does not exceed 5·25 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\ D = N.$

Iron Plates from $\frac{1}{4}$ inch to $\frac{5}{8}$ inch thick.

Pressure per sq. in.	Pressure Numerals.	Thickness.	Constants.	*Maximum Lengths for Thickness in inches.
lbs.	N.	inches.	C.	
		¼	63·0	18·0
		9/32	72·375	21·75
165	3·3			
		5/16	81·75	25·50
170	3·4			
		11/32	91·125	29·25
175	3·5			
		⅜	100·50	33·0
180	3·6			
		13/32	109·875	36·75
185	3·7			
		7/16	119·25	40·50
190	3·8			
		15/32	128·625	44·25
195	3·9			
		½	138·0	48·0
200	4·0			
		17/32	147·375	51·75
		9/16	156·75	55·50
		19/32	166·125	59·25
		⅝	175·50	63·0

The right-hand columns are headed: Constants and Maximum Lengths for the Thicknesses which they are opposite.

* The lengths opposite the thickness in each case are the maximum lengths, in inches, between the centres of the flanges, for which the Table should be used. When the length exceeds that opposite the given thickness then the pressure may be found from Tables Nos. 271 to 283.

N = Pressure numeral. C = Thickness constant. D = Diameter, outside, in inches.
l = Length between centres of flanges, in inches. See notes, page 187 and following.

$$\frac{C-l}{N}=D. \qquad C-ND=l. \qquad ND+l=C. \qquad \frac{C-l}{D}=N.$$

FURNACES, CORRUGATED, CYLINDRICAL.

Iron Plates from $\frac{1}{4}$ inch to $\frac{5}{8}$ inch thick.

Pressures and Diameters when *machine* made.

TABLE NO. 285.

Pressure per square inch.	Thicknesses and Diameters.*												
	¼ in.	9/32 in.	5/16 in.	11/32 in.	⅜ in.	13/32 in.	7/16 in.	15/32 in.	½ in.	17/32 in.	9/16 in.	19/32 in.	⅝ in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs. 165	13·63	15·34	17·04	18·75	20·45	22·15	23·86	25·56	27·27	28·97	30·68	32·38	34·09
170	13·23	14·88	16·54	18·19	19·85	21·50	23·16	24·81	26·47	28·12	29·77	31·43	33·08
175	12·85	14·46	16·07	17·67	19·28	20·89	22·50	24·10	25·71	27·32	28·92	30·53	32·14
180	12·50	14·06	15·62	17·18	18·75	20·31	21·87	23·43	25·00	26·56	28·12	29·68	31·25
185	12·16	13·68	15·20	16·72	18·24	19·76	21·28	22·80	24·32	25·84	27·36	28·88	30·40
190	11·84	13·32	14·80	16·28	17·76	19·24	20·72	22·20	23·68	25·16	26·64	28·12	29·60
195	11·53	12·98	14·42	15·86	17·30	18·75	20·19	21·63	23·07	24·51	25·96	27·40	28·84
200	11·25	12·65	14·06	15·46	16·87	18·28	19·68	21·09	22·50	23·90	25·31	26·71	28·12

* The diameter is the *mean* diameter, which is half the sum of the outside diameters, the one being measured from the top of the corrugations, the other from the bottom of the corrugations. See notes page 191 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{1}{4}$ inch thick.

TABLE NO. 286.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	4·66	21·7	4·43	19·6	4·21	17·7	3·69	13·6	3·50	12·2	...	...	...	...
170	...	...	...	...	4·59	21·1	4·38	19·1	4·16	17·3	3·63	13·2	...	...	...	...	...	...
175	...	...	...	...	4·53	20·5	4·32	18·7	4·11	16·9	3·58	12·8	...	...	...	...	...	...
180	...	...	...	...	4·47	20·0	4·27	18·2	4·07	16·5	3·53	12·5	...	...	...	...	...	...
185	...	...	...	...	4·42	19·5	4·22	17·8	4·02	16·2	...	...	...	...	...	...	...	...
190	...	...	...	...	4·36	19·0	4·17	17·4	3·97	15·7	...	...	...	...	...	...	...	...
195	...	...	...	...	4·32	18·6	4·13	17·0	3·92	15·3	...	...	...	...	...	...	...	...
200	...	...	...	...	4·27	18·2	4·09	16·7	3·87	15·0	...	...	...	...	...	...	...	...
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{9}{32}$ inch thick.

TABLE No. 287.

Pressure per. sq. in.	$*A_1$		$*B_1$		$*C_1$		$*D_1$		$*E_1$		$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	5·12	26·2	4·85	23·5	4·58	21·0	4·05	16·4	3·85	14·8	3·81	14·5	...	...
170	...	...	...	...	5·04	25·4	4·78	22·8	4·52	20·4	4·00	16·0	3·79	14·4	3·75	14·0	...	...
175	...	...	...	...	4·97	24·7	4·71	22·2	4·46	19·9	3·94	15·5	3·74	14·0	3·70	13·6	...	...
180	...	...	...	...	4·90	24·0	4·65	21·6	4·41	19·4	3·89	15·1	3·69	13·6	3·64	13·3	..	...
185	...	...	...	...	4·83	23·3	4·59	21·1	4·35	18·9	3·83	14·7	3·64	13·2	3·59	12·9	...	...
190	...	...	...	...	4·77	22·7	4·54	20·6	4·30	18·5	3·78	14·3	3·59	12·8	3·55	12·6	...	...
195	...	...	...	...	4·71	22·2	4·48	20·1	4·26	18·1	3·73	13·9	3·54	12·5	3·50	12·2	...	...
200	...	...	...	...	4·65	21·6	4·43	19·6	4·21	17·7	3·69	13·6	3·50	12·2	...	...	...	...
	$*A_1$		$*B_1$		$*C_1$		$*D_1$		$*E_1$		$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{5}{16}$ inch thick.

TABLE No. 288.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	5·63	31·7	5·31	28·2	4·99	24·9	4·36	19·0	4·16	17·3	4·13	17·0	...	...
170	...	..	...	...	5·53	30·6	5·23	27·3	4·92	24·2	4·30	18·5	4·11	16·9	4·08	16·6	...	...
175	...	...	...	..	5·45	29·7	5·15	26·5	4·85	23·5	4·25	18·0	4·07	16·5	4·03	16·2	...	...
180	...	...	...	...	5·36	28·7	5·07	25·7	4·78	22·8	4·20	17·6	4·02	16·2	3·98	15·8	...	...
185	...	...	...	...	5·28	27·9	5·00	25·0	4·72	22·2	4·15	17·2	3·97	15·7	3·92	15·4	...	...
190	...	...	...	...	5·21	27·1	4·93	24·3	4·66	21·7	4·10	16·8	3·91	15·3	3·87	15·0	...	...
195	..	...	...	...	5·14	26·4	4·87	23·7	4·60	21·1	4·06	16·5	3·86	14·9	3·82	14·6	...	...
200	...	...	...	...	5·07	25·7	4·81	23·1	4·55	20·7	4·02	16·2	3·81	14·5	3·77	14·2	...	...
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{11}{32}$ inch thick.

TABLE No. 289.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	6·16	38·0	5·81	33·7	5·43	29·5	4·69	21·9	4·46	19·9	4·42	19·5	3·48	12·1
170	...	...	...	...	6·07	36·8	5·71	32·6	5·35	28·6	4·62	21·3	4·40	19·4	4·36	19·0	...	...
175	...	...	...	...	5·97	35·6	5·61	31·5	5·26	27·7	4·56	20·8	4·35	18·9	4·31	18·5	...	...
180	...	...	...	...	5·87	34·4	5·53	30·5	5·18	26·9	4·50	20·2	4·29	18·4	4·25	18·1	...	...
185	...	...	...	...	5·78	33·4	5·44	29·6	5·11	26·1	4·44	19·7	4·24	18·0	4·20	17·7	...	...
190	...	...	...	...	5·69	32·3	5·36	28·8	5·04	25·4	4·39	19·3	4·20	17·6	4·16	17·3	...	...
195	...	...	...	...	5·61	31·4	5·29	28·0	4·97	24·7	4·34	18·8	4·15	17·2	4·11	16·9	...	...
200	...	...	...	...	5·53	30·5	5·22	27·2	4·91	24·1	4·29	18·4	4·11	16·9	4·07	16·6	...	...
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{3}{8}$ inch thick.

TABLE No. 290.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	6·56	43·1	6·27	39·4	5·91	34·9	5·04	25·4	4·78	22·9	4·73	22·4	3·75	14·1
170	...	...	...	...	6·48	42·0	6·19	38·4	5·81	33·7	4·97	24·7	4·72	22·2	4·67	21·7	3·70	13·6
175	...	...	...	...	6·40	41·0	6·12	37·5	5·71	32·6	4·90	24·0	4·65	21·6	4·60	21·2	3·64	13·3
180	...	...	...	...	6·32	40·0	6·02	36·2	5·62	31·6	4·83	23·3	4·59	21·0	4·54	20·6	3·59	12·9
185	...	...	...	...	6·25	39·1	5·92	35·1	5·54	30·6	4·76	22·7	4·53	20·5	4·49	20·1	3·54	12·5
190	...	...	...	...	6·18	38·2	5·83	34·0	5·45	29·7	4·70	22·1	4·48	20·0	4·43	19·6	3·50	12·2
195	...	...	...	...	6·11	37·3	5·74	33·0	5·38	28·9	4·64	21·6	4·42	19·6	4·38	19·2	...	...
200	...	...	...	...	6·02	36·2	5·66	32·0	5·30	28·1	4·59	21·0	4·38	19·1	4·33	18·8	...	...
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{13}{32}$ inch thick.

TABLE No. 291.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	...	...	...	...	6·97	48·6	6·66	44·3	6·33	40·0	5·43	29·5	5·13	26·3	5·07	25·7	4·02	16·2
170	...	...	...	...	6·88	47·3	6·57	43·2	6·25	39·0	5·34	28·5	5·05	25·5	4·99	24·9	3·96	15·7
175	...	...	...	...	6·79	46·1	6·49	42·1	6·17	38·1	5·26	27·6	4·98	24·8	4·92	24·2	3·90	15·2
180	...	...	...	...	6·71	45·0	6·41	41·1	6·09	37·1	5·18	26·8	4·91	24·1	4·85	23·5	3·85	14·8
185	...	...	...	...	6·63	44·0	6·34	40·2	5·99	35·9	5·11	26·1	4·84	23·4	4·79	22·9	3·80	14·4
190	...	...	...	...	6·55	43·0	6·27	39·3	5·90	34·8	5·04	25·4	4·78	22·8	4·73	22·3	3·75	14·0
195	...	...	...	...	6·48	42·0	6·20	38·4	5·81	33·8	4·97	24·7	4·72	22·2	4·67	21·8	3·70	13·7
200	...	...	...	...	6·41	41·1	6·13	37·6	5·73	32·8	4·91	24·1	4·66	21·7	4·61	21·2	3·65	13·3
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{7}{16}$ inch thick.

TABLE No. 292.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	9·14	83·5	...	...	7·38	54·4	7·04	49·6	6·69	44·7	5·84	34·1	5·50	30·2	5·43	29·5	4·24	17·9
170	...	...	...	...	7·28	53·0	6·95	48·3	6·60	43·6	5·74	32·9	5·41	29·3	5·34	28·6	4·19	17·5
175	...	...	...	...	7·19	51·7	6·86	47·1	6·52	42·5	5·65	31·9	5·33	28·4	5·26	27·7	4·14	17·1
180	...	...	...	...	7·10	50·4	6·78	46·0	6·44	41·5	5·56	30·9	5·25	27·5	5·18	26·9	4·09	16·7
185	...	...	...	...	7·01	49·2	6·70	44·9	6·37	40·5	5·47	29·9	5·17	26·7	5·11	26·1	4·04	16·3
190	...	..	...	...	6·93	48·1	6·62	43·8	6·30	39·6	5·39	29·1	5·10	26·0	5·04	25·4	4·00	16·0
195	...	...	...	...	6·85	47·0	6·55	42·9	6·23	38·8	5·32	28·3	5·03	25·3	4·97	24·7	3·95	15·5
200	...	...	...	...	6·78	46·0	6·48	42·0	6·16	38·0	5·25	27·5	4·97	24·7	4·91	24·1	3·90	15·2
	*A_1		*B_1		*C_1		*D_1		E^*_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{15}{32}$ inch thick.

TABLE NO. 293.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	9·67	93·5	9·38	88·1	7·79	60·7	7·43	55·2	7·05	49·7	6·23	38·8	5·89	34·7	5·82	33·8	4·47	20·0
170	9·54	91·0	9·25	85·6	7·69	59·1	7·33	53·8	6·96	48·5	6·15	37·8	5·79	33·5	5·72	32·7	4·41	19·4
175	9·41	88·5	9·13	83·4	7·59	57·6	7·24	52·4	6·87	47·2	6·06	36·7	5·70	32·5	5·63	31·6	4·35	18·9
180	9·28	86·2	9·01	81·2	7·49	56·1	7·15	51·1	6·79	46·1	5·96	35·5	5·61	31·4	5·54	30·6	4·30	18·5
185	9·17	84·1	...	...	7·40	54·8	7·06	49·9	6·71	45·0	5·86	34·4	5·52	30·5	5·45	29·7	4·25	18·0
190	9·05	82·0	...	...	7·31	53·5	6·98	48·7	6·63	44·0	5·77	33·3	5·44	29·6	5·37	28·9	4·20	17·6
195	...	...	...	...	7·23	52·3	6·90	47·6	6·56	43·0	5·69	32·3	5·36	28·8	5·30	28·1	4·16	17·3
200	...	...	...	...	7·15	51·1	6·83	46·6	6·49	42·1	5·61	31·4	5·29	28·0	5·23	27·3	4·11	16·9
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{1}{2}$ inch thick.

TABLE No. 294.

Pressure per sq. in.	$*A_1$		$*B_1$		$*C_1$		$*D_1$		$*E_1$		$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	10·20	104·1	9·90	98·0	8·20	67·3	7·82	61·2	7·42	55·0	6·54	42·8	6·25	39·1	6·19	38·4	4·71	22·2
170	10·06	101·2	9·76	95·3	8·09	65·5	7·72	59·6	7·32	53·6	6·46	41·7	6·17	38·1	6·12	37·4	4·65	21·6
175	9·92	98·5	9·63	92·7	7·99	63·8	7·62	58·0	7·23	52·2	6·38	40·7	6·09	37·1	6·01	36·1	4·58	21·0
180	9·79	96·0	9·50	90·3	7·89	62·2	7·52	56·6	7·14	51·0	6·30	39·7	5·99	35·9	5·91	34·9	4·53	20·5
185	9·67	93·5	9·38	88·0	7·79	60·7	7·43	55·2	7·05	49·7	6·23	38·8	5·89	34·7	5·82	33·8	4·47	19·9
190	9·55	91·2	9·27	85·9	7·70	59·2	7·34	53·9	6·97	48·6	6·16	37·9	5·80	33·7	5·73	32·8	4·42	19·5
195	9·43	89·0	9·15	83·8	7·61	57·9	7·26	52·7	6·89	47·5	6·08	37·0	5·72	32·7	5·64	31·8	4·37	19·0
200	9·32	87·0	9·05	81·9	7·52	56·6	7·18	51·5	6·82	46·5	5·99	35·9	5·64	31·7	5·56	31·0	4·32	18·6
	$*A_1$		$*B_1$		$*C_1$		$*D_1$		$*E_1$		$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{17}{32}$ inch thick.

TABLE No. 295.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	10·74	115·3	10·42	108·5	8·62	74·3	8·21	67·5	7·79	60·6	6·85	47·0	6·55	42·9	6·48	42·1	4·97	24·7
170	10·59	112·1	10·27	105·5	8·50	72·3	8·10	65·7	7·68	59·0	6·76	45·8	6·46	41·8	6·40	41·0	4·90	24·0
175	10·44	109·1	10·13	102·6	8·39	70·4	8·00	64·0	7·58	57·5	6·68	44·6	6·38	40·8	6·32	40·0	4·83	23·3
180	10·31	106·2	10·00	100·0	8·28	68·6	7·90	62·4	7·49	56·1	6·60	43·6	6·31	39·8	6·25	39·0	4·76	22·7
185	10·17	103·5	9·87	97·4	8·18	66·9	7·80	60·8	7·40	54·7	6·52	42·5	6·24	38·9	6·18	38·1	4·70	22·1
190	10·05	101·0	9·75	95·0	8·08	65·3	7·71	59·4	7·31	53·5	6·45	41·6	6·17	38·0	6·10	37·2	4·64	21·5
195	9·92	98·5	9·63	92·7	7·99	63·8	7·62	58·0	7·23	52·2	6·38	40·7	6·09	37·1	6·01	36·1	4·58	21·0
200	9·81	96·2	9·51	90·6	7·90	62·4	7·53	56·7	7·15	51·1	6·31	39·8	6·00	36·0	5·92	35·0	4·53	20·5
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{9}{16}$ inch thick.

TABLE NO. 296.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	11·27	127·2	10·93	119·6	9·04	81·7	8·61	74·1	8·16	66·6	7·17	51·4	6·85	46·9	6·78	46·0	5·25	27·5
170	11·12	123·6	10·78	116·2	8·91	79·5	8·49	72·1	8·05	64·8	7·08	50·1	6·76	45·7	6·69	44·8	5·16	26·6
175	10·96	120·2	10·63	113·1	8·80	77·4	8·38	70·2	7·94	63·1	6·99	48·8	6·67	44·5	6·61	43·7	5·09	25·9
180	10·82	117·1	10·49	110·1	8·68	75·4	8·27	68·5	7·84	61·5	6·90	47·6	6·59	43·5	6·53	42·6	5·01	25·1
185	10·68	114·1	10·36	107·3	8·57	73·5	8·17	66·8	7·75	60·0	6·82	46·5	6·51	42·4	6·45	41·6	4·94	24·4
190	10·54	111·2	10·23	104·6	8·47	71·7	8·07	65·2	7·65	58·6	6·74	45·4	6·44	41·5	6·38	40·7	4·88	23·8
195	10·42	108·5	10·10	102·1	8·37	70·1	7·98	63·6	7·56	57·2	6·66	44·4	6·37	40·6	6·31	39·8	4·82	23·2
200	10·29	106·0	9·98	99·7	8·27	68·5	7·89	62·2	7·48	56·0	6·59	43·5	6·30	39·7	6·24	39·0	4·76	22·6
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; **these conditions, with their distinguishing letters, will be found on page 195 and following.**

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{19}{32}$ inch thick.

TABLE No. 297.

Pressure per sq. in.	*A₁		*B₁		*C₁		*D₁		*E₁		*F₁G₁		*H₁		*r G₁		*I₁	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	11·81	139·6	11·45	131·2	9·46	89·5	9·00	81·0	8·53	72·8	7·49	56·1	7·14	51·1	7·07	50·1	5·53	30·6
170	11·65	135·7	11·29	127·5	9·33	87·0	8·88	78·9	8·41	70·8	7·39	54·6	7·05	49·7	6·98	48·8	5·44	29·6
175	11·49	132 0	11·14	124·1	9·20	84·7	8·76	76·8	8·30	69·0	7·29	53·2	6·96	48·5	6·89	47·5	5·36	28·7
180	11·33	128·5	10·99	120·8	9·08	82·5	8·65	74·9	8·20	67·2	7·20	51·9	6·88	47·3	6·81	46·4	5·28	27·8
185	11·18	125·1	10·85	117·7	8·97	80·4	8·54	73·0	8·10	65·5	7·12	50·6	6·79	46·2	6·73	45·3	5·20	27·0
190	11·04	122·0	10·71	114·7	8·86	78·5	8·44	71·2	8·00	64·0	7·03	49·5	6·72	45·1	6·65	44·2	5·13	26·3
195	10·91	119·0	10·58	112·0	8·75	76·6	8·34	69·6	7·90	62·5	6·95	48·4	6·64	44·1	6·58	43·3	5·06	25·6
200	10·78	116·2	10·45	109·3	8·65	74·9	8·24	68·0	7·81	61·1	6·88	47·3	6·57	43·2	6·51	42·3	4·99	24·9
	*A₁		*B₁		*C₁		*D₁		*E₁		*F₁G₁		*H₁		*r G₁		*I₁	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{5}{8}$ inch thick.

TABLE No. 298.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1 G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	12·35	152·6	11·98	143·5	9·88	97·6	9·40	88·5	8·90	79·3	7·81	61·0	7·45	55·5	7·37	54·4	5·83	34·0
170	12·18	148·3	11·81	139·4	9·74	94·9	9·27	86·0	8·78	77·1	7·70	59·3	7·35	54·0	7·27	52·9	5·73	32·9
175	12·01	144·2	11·64	135·6	9·61	92·4	9·15	83·7	8·66	75·1	7·60	57·8	7·25	52·6	7·18	51·6	5·64	31·8
180	11·85	140·4	11·49	132·0	9·48	90·0	9·03	81·6	8·55	73·2	7·51	56·4	7·16	51·3	7·09	50·3	5·55	30·8
185	11·69	136·8	11·34	128·6	9·36	87·7	8·92	79·5	8·45	71·4	7·42	55·0	7·08	50·1	7·01	49·1	5·47	29·9
190	11·54	133·3	11·19	125·4	9·25	85·6	8·81	77·6	8·34	69·6	7·33	53·7	7·00	49·0	6·93	48·0	5·39	29·0
195	11·40	130·1	11·06	122·3	9·14	83·5	8·70	75·8	8·25	68·0	7·24	52·5	6·92	47·8	6·85	46·9	5·31	28·2
200	11·27	127·0	10·92	119·4	9·03	81·6	8·60	74·0	8·15	66·5	7·16	51·3	6·84	46·8	6·77	45·9	5·24	27·5
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1 G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressure, Pitches, and Surfaces.

Steel Plate $\frac{21}{32}$ inch thick.

TABLE No. 299.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1 G_1		*H_1		r G^*_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq.ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins,	ins.	sq. ins.
165	12·89	166·3	12·50	156·2	10·30	106·1	9·80	96·1	9·28	86·1	8·13	66·1	7·75	60·1	7·67	58·9	6·14	37·4
170	12·71	161·5	12·32	151·8	10·16	103·2	9·67	93·5	9·15	83·7	8·02	64·3	7·65	58·5	7·57	57·3	6·04	36·5
175	12·53	157·1	12·15	147·6	10·02	100·4	9·54	91·0	9·03	81·5	7·91	62·6	7·55	57·0	7·47	55·8	5·94	35·2
180	12·36	152·9	11·99	143·7	9·89	97·8	9·41	88·6	8·91	79·4	7·81	61·1	7·45	55·5	7·38	54·4	5·84	34·1
185	12·20	148·9	11·83	140·0	9·76	95·3	9·29	86·4	8·80	77·4	7·72	59·6	7·36	54·2	7·29	53·1	5·75	33·0
190	12·05	145·2	11·68	136·5	9·64	93·0	9·18	84·3	8·69	75·6	7·63	58·2	7·27	52·9	7·20	51·9	5·66	32·0
195	11·90	141·6	11·54	133·1	9·52	90·7	9·07	82·2	8·59	73·8	7·54	56·8	7·19	51·7	7·12	50·7	5·58	31·1
200	11·75	138·2	11·40	129·9	9·41	88·6	8·96	80·3	8·49	72·1	7·45	55·5	7·11	50·6	7·04	49·6	5·50	30·2
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1 G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{11}{16}$ inch thick.

TABLE NO. 300.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	13·43	180·5	13·02	169·6	10·72	115·0	10·20	104·1	9·65	93·2	8·45	71·4	8·05	64·9	7·97	63·6	6·36	40·5
170	13·24	175·4	12·83	164·8	10·57	111·8	10·06	101·2	9·52	90·7	8·33	69·5	7·94	63·1	7·86	61·9	6·28	39·5
175	13·06	170·5	12·66	160·2	10·43	108·8	9·92	98·5	9·39	88·2	8·22	67·7	7·84	61·5	7·76	60·3	6·21	38·5
180	12·88	166·0	12·49	156·0	10·29	106·0	9·79	96·0	9·27	86·0	8·12	66·0	7·74	60·0	7·66	58·8	6·13	37·6
185	12·71	161·6	12·32	151·9	10·16	103·2	9·67	93·5	9·15	83·8	8·02	64·3	7·65	58·5	7·57	57·3	6·04	36·5
190	12·55	157·5	12·17	148·1	10·03	100·7	9·55	91·2	9·04	81·7	7·92	62·8	7·56	57·1	7·48	56·0	5·95	35·4
195	12·39	153·6	12·02	144·4	9·91	98·3	9·43	89·0	8·93	79·8	7·83	61·3	7·47	55·8	7·39	54·7	5·86	34·3
200	12·24	150·0	11·87	141·0	9·79	96·0	9·32	87·0	8·83	78·0	7·74	60·0	7·39	54·6	7·31	53·5	5·77	33·3
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{23}{32}$ inch thick.

TABLE No. 301.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	13·97	195·3	13·54	183·5	11·15	124·3	10·60	112·5	10·03	100·6	8·77	77·0	8·36	69·9	8·27	68·5	6·59	43·5
170	13·77	189·8	13·35	178·3	10·99	120·8	10·46	109·4	9·89	97·9	8·65	74·9	8·24	68·0	8·16	66·6	6·51	42·3
175	13·58	184·5	13·16	173·4	10·84	117·6	10·31	106·4	9·76	95·2	8·54	72·9	8·14	66·2	8·05	64·9	6·43	41·3
180	13·4	179·6	12·99	168·7	10·70	114·5	10·18	103·6	9·63	92·8	8·43	71·1	8·03	64·5	7·95	63·2	6·35	40·3
185	13·22	174·9	12·82	164·3	10·56	111·5	10·05	101·0	9·51	90·4	8·32	69·3	7·93	63·0	7·85	61·7	6·28	39·4
190	13·05	170·4	12·65	160·1	10·43	108·7	9·92	98·5	9·39	88·2	8·22	67·6	7·84	61·5	7·76	60·2	6·21	38·5
195	12·89	166·2	12·50	156·2	10·30	106·1	9·80	96·1	9·28	86·1	8·13	66·0	7·75	60·0	7·67	58·8	6·14	37·7
200	12·73	162·2	12·34	152·4	10·18	103·6	9·69	93·8	9·17	84·1	8·03	64·5	7·66	58·7	7·58	57·5	6·05	36·7
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{3}{4}$ inch thick.

TABLE No. 302.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	14·52	210·8	14·07	198·0	11·57	134·0	11·01	121·2	10·41	108·4	9·10	82·8	8·66	75·1	8·58	73·6	6·82	46·5
170	14·31	204·8	13·87	192·3	11·41	130·2	10·85	117·8	10·26	105·4	8·97	80·5	8·55	73·1	8·46	71·6	6·73	45·3
175	14·11	199·1	13·67	187·0	11·25	126·7	10·70	114·6	10·12	102·5	8·85	78·4	8·43	71·1	8·35	69·7	6·65	44·2
180	13·92	193·7	13·49	182·0	11·10	123·3	10·56	111·6	9·99	99·8	8·74	76·4	8·33	69·3	8·24	67·9	6·57	43·1
185	13·73	188·7	13·31	177·2	10·96	120·1	10·43	108·7	9·86	97·3	8·63	74·5	8·22	67·6	8·14	66·2	6·49	42·1
190	13·56	183·8	13·14	172·7	10·82	117·1	10·29	106·0	9·74	94·9	8·52	72·7	8·12	66·0	8·04	64·7	6·42	41·2
195	13·39	179·3	12·98	168·5	10·69	114·3	10·17	103·5	9·62	92·6	8·42	71·0	8·03	64·5	7·95	63·2	6·35	40·3
200	13·22	175·0	12·82	164·4	10·56	111·6	10·05	101·0	9·51	90·5	8·33	69·3	7·94	63·0	7·86	61·7	6·28	39·4
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{25}{32}$ inch thick.

TABLE No. 303.

Pressure per sq. in.	$*A_1$		$*B_1$		$*C_1$		$*D_1$		$*E_1$		$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	15·06	226·9	14·59	213·1	12·00	144·0	11·41	130·2	10·79	116·4	9·42	88·8	8·97	80·5	8·88	78·9	7·05	49·7
170	14·84	220·4	14·38	207·0	11·83	140·0	11·25	126·6	10·64	113·2	9·29	86·4	8·85	78·3	8·76	76·7	6·96	48·4
175	14·63	214·2	14·18	201·2	11·67	136·1	11·09	123·1	10·49	110·1	9·17	84·1	8·73	76·2	8·64	74·7	6·87	47·2
180	14·44	208·5	13·99	195·8	11·51	132·5	10·95	119·9	10·35	107·2	9·05	81·9	8·62	74·3	8·53	72·8	6·79	46·0
185	14·24	203·0	13·81	190·7	11·36	129·1	10·80	116·8	10·22	104·5	8·93	79·8	8·51	72·4	8·42	71·0	6·71	45·0
190	14·06	197·8	13·63	185·8	11·22	125·9	10·67	113·9	10·09	101·9	8·82	77·9	8·41	70·7	8·32	69·3	6·63	43·9
195	13·89	192·9	13·46	181·2	11·08	122·8	10·54	111·1	9·97	99·4	8·72	76·0	8·31	69·0	8·22	67·6	6·55	43·0
200	13·72	188·2	13·29	176·8	10·95	119·9	10·41	108·5	9·85	97·1	8·62	74·3	8·21	67·5	8·13	66·1	6·48	42·0
	$*A_1$		$*B_1$		$*C_1$		$*D_1$		$*E_1$		$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces

Steel Plate $\frac{13}{16}$ inch thick.

TABLE No. 304.

Pressure per sq. in.	*A_1 Pitch	*A_1 Surface	*B_1 Pitch	*B_1 Surface	*C_1 Pitch	*C_1 Surface	*D_1 Pitch	*D_1 Surface	*E_1 Pitch	*E_1 Surface	*F_1G_1 Pitch	*F_1G_1 Surface	*H_1 Pitch	*H_1 Surface	*r G_1 Pitch	*r G_1 Surface	*I_1 Pitch	*I_1 Surface
lbs.	ins.	sq.ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	15·60	243·5	15·12	228·7	12·43	154·4	11·81	139·6	11·17	124·7	9·75	95·0	9·28	86·1	9·18	84·4	7·28	53·0
170	15·38	236·5	14·90	222·1	12·25	150·1	11·65	135·7	11·01	121·2	9·61	92·4	9·15	83·8	9·06	82·0	7·18	51·6
175	15·16	230·0	14·69	216·0	12·08	146·0	11·49	132·0	10·86	118·0	9·48	90·0	9·03	81·6	8·94	79·9	7·09	50·3
180	14·96	223·7	14·49	210·1	11·92	142·1	11·33	128·5	10·71	114·8	9·36	87·6	8·91	79·5	8·82	77·8	7·00	49·0
185	14·76	217·8	14·30	204·6	11·76	138·4	11·18	125·1	10·58	111·9	9·24	85·4	8·80	77·5	8·71	75·9	6·92	47·9
190	14·57	212·3	14·12	199·4	11·61	134·9	11·04	122·0	10·44	109·1	9·13	83·3	8·69	75·6	8·60	74·0	6·84	46·8
195	14·38	207·0	13·94	194·4	11·47	131·6	10·91	119·0	10·32	106·5	9·02	81·3	8·59	73·8	8·50	72·3	6·76	45·8
200	14·21	202·0	13·77	189·7	11·33	128·5	10·78	116·2	10·19	104·0	8·91	79·5	8·49	72·1	8·40	70·6	6·69	44·8
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{27}{32}$ inch thick.

TABLE No. 305.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	16·15	260·8	15·65	244·9	12·85	165·2	12·22	149·3	11·55	133·4	10·07	101·5	9·59	92·0	9·49	90·1	7·51	56·4
170	15·91	253·3	15·42	237·8	12·67	160·5	12·04	145·1	11·38	129·6	9·93	98·7	9·46	89·4	9·36	87·6	7·41	54·9
175	15·69	246·2	15·20	231·2	12·49	156·1	11·88	141·1	11·23	126·1	9·80	96·1	9·33	87·0	9·23	85·2	7·32	53·5
180	15·48	239·6	15·00	225·0	12·33	152·0	11·72	137·4	11·08	122·8	9·67	93·6	9·21	84·8	9·11	83·0	7·22	52·2
185	15·27	233·2	14·80	219·0	12·16	148·0	11·57	133·8	10·93	119·6	9·55	91·2	9·09	82·7	9·00	81·0	7·14	51·0
190	15·07	227·3	14·61	213·4	12·01	144·3	11·42	130·4	10·80	116·6	9·43	88·9	8·98	80·6	8·89	79·0	7·05	49·8
195	14·88	221·6	14·42	208·1	11·86	140·7	11·28	127·2	10·66	113·8	9·32	86·8	8·87	78·7	8·78	77·1	6·97	48·6
200	14·70	216·2	14·25	203·1	11·72	137·4	11·14	124·2	10·54	111·1	9·21	84·8	8·77	76·9	8·68	75·3	6·90	47·6
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{7}{8}$ inch thick.

TABLE No. 306.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	16·69	278·7	16·17	261·6	13·28	176·4	12·62	159·4	11·93	142·3	10·40	108·2	9·90	98·0	9·79	96·0	7·74	60·0
170	16·45	270·7	15·94	254·1	13·09	171·4	12·44	154·8	11·76	138·3	10·26	105·2	9·76	95·3	9·66	93·3	7·64	58·4
175	16·22	263·1	15·71	247·0	12·91	166·7	12·27	150·6	11·60	134·5	10·12	102·4	9·63	92·7	9·53	90·8	7·54	56·9
180	16·00	256·0	15·50	240·3	12·73	162·2	12·10	146·6	11·44	131·0	9·98	99·7	9·50	90·3	9·40	88·5	7·45	55·5
185	15·78	249·2	15·29	234·0	12·57	158·0	11·95	142·8	11·29	127·6	9·86	97·2	9·38	88·0	9·28	86·2	7·36	54·1
190	15·58	242·8	15·10	228·0	12·41	154·0	11·80	139·2	11·15	124·4	9·73	94·8	9·27	85·9	9·17	84·1	7·27	52·8
195	15·38	236·7	14·91	222·3	12·25	150·2	11·65	135·8	11·01	121·3	9·62	92·5	9·15	83·8	9·06	82·1	7·19	51·6
200	15·19	231·0	14·72	216·9	12·10	146·6	11·51	132·5	10·88	118·5	9·50	90·3	9·05	81·9	8·95	80·2	7·11	50·5
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{29}{32}$ inch thick. TABLE No. 307.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	17·24	297·2	16·70	279·0	13·71	188·0	13·03	169·8	12·31	151·6	10·73	115·2	10·21	104·2	10·10	102·1	7·97	63·6
170	16·99	288·6	16·46	270·9	13·51	182·6	12·84	164·9	12·13	147·3	10·58	111·9	10·07	101·3	9·96	99·2	7·87	61·9
175	16·75	280·5	16·23	263·4	13·32	177·6	12·66	160·4	11·97	143·2	10·43	108·9	9·93	98·6	9·82	96·6	7·77	60·3
180	16·52	272·9	16·00	256·0	13·14	172·8	12·49	156·1	11·81	139·4	10·30	106·1	9·80	96·0	9·70	94·0	7·67	58·8
185	16·30	265·7	15·79	249·4	12·97	168·3	12·33	152·0	11·65	135·8	10·16	103·3	9·67	93·6	9·57	91·7	7·57	57·4
190	16·09	258·8	15·59	243·0	12·80	164·0	12·17	148·2	11·50	132·4	10·04	100·8	9·55	91·3	9·45	89·4	7·48	56·0
195	15·88	252·4	15·39	237·0	12·65	160·0	12·02	144·6	11·36	129·2	9·92	98·4	9·44	89·1	9·34	87·3	7·40	54·7
200	15·69	246·2	15·20	231·2	12·49	156·1	11·88	141·1	11·23	126·1	9·80	96·0	9·33	87·0	9·23	85·2	7·32	53·5
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{15}{16}$ inch thick.

TABLE No. 308.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq.ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	17·78	316·3	17·23	296·9	14·14	199·9	13·43	180·5	12·69	161·1	11·06	122·3	10·52	110·7	10·41	108·4	8·21	67·4
170	17·52	307·1	16·98	288·3	13·93	194·2	13·24	175·4	12·51	156·5	10·90	118·9	10·37	107·6	10·26	105·3	8·10	65·6
175	17·28	298·5	16·74	280·2	13·74	188·8	13·06	170·5	12·34	152·2	10·75	115·7	10·23	104·7	10·12	102·5	7·99	63·9
180	17·04	290·4	16·51	272·6	13·55	183·7	12·88	166·0	12·17	148·2	10·61	112·6	10·10	102·0	9·99	99·8	7·89	62·3
185	16·81	282·7	16·29	265·4	13·37	178·9	12·71	161·6	12·01	144·3	10·47	109·7	9·97	99·4	9·86	97·3	7·79	60·7
190	16·59	275·4	16·08	258·6	13·20	174·4	12·55	157·5	11·86	140·7	10·34	107·0	9·84	96·9	9·74	94·9	7·70	59·3
195	16·38	268·5	15·88	252·1	13·04	170·1	12·39	153·6	11·71	137·2	10·22	104·4	9·72	94·6	9·62	92·6	7·61	57·9
200	16·18	262·0	15·68	246·0	12·88	166·0	12·24	150·0	11·57	134·0	10·10	102·0	9·61	92·4	9·51	90·4	7·53	56·6
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $\frac{31}{32}$ inch thick.

TABLE No. 309.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq.ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	18·33	336·0	17·75	315·3	14·56	212·2	13·84	191·6	13·07	171·0	11·39	129·7	10·83	117·3	10·72	114·9	8·44	71·3
170	18·06	326·2	17·50	306·2	14·36	206·1	13·64	186·1	12·89	166·1	11·23	126·1	10·68	114·0	10·56	111·6	8·33	69·4
175	17·80	317·1	17·25	297·6	14·15	200·4	13·45	181·0	12·71	161·5	11·07	122·6	10·53	111·0	10·42	108·6	8·22	67·6
180	17·56	308·5	17·01	289·5	13·96	195·0	13·27	176·1	12·54	157·2	10·92	119·4	10·39	108·0	10·28	105·8	8·11	65·8
185	17·33	300·3	16·79	281·9	13·78	189·9	13·09	171·5	12·37	153·1	10·78	116·3	10·26	105·3	10·15	103·1	8·01	64·2
190	17·10	292·5	16·57	274·6	13·60	185·1	12·93	167·2	12·21	149·2	10·65	113·4	10·13	102·7	10·02	100·5	7·92	62·7
195	16·88	285·2	16·36	267·7	13·43	180·5	12·77	163·0	12·06	145·6	10·52	110·7	10·01	100·2	9·90	98·1	7·82	61·2
200	16·68	278·2	16·16	261·2	13·27	176·1	12·61	159·1	11·92	142·1	10·39	108·0	9·89	97·8	9·79	95·8	7·74	59·9
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate 1 inch thick.

TABLE No. 310.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	18·87	356·3	18·28	334·4	15·00	225·0	14·25	203·0	13·46	181·1	11·72	137·3	11·14	124·2	11·02	121·6	8·68	75·3
170	18·60	346·0	18·02	324·7	14·78	218·5	14·04	197·2	13·26	176·0	11·55	133·5	10·98	120·7	10·87	118·2	8·56	73·3
175	18·33	336·2	17·76	315·6	14·57	212·4	13·84	191·7	13·08	171·1	11·39	129·8	10·83	117·4	10·72	114·9	8·45	71·3
180	18·08	327·1	17·52	307·0	14·37	206·6	13·66	186·6	12·90	166·5	11·24	126·4	10·69	114·3	10·58	111·9	8·34	69·5
185	17·84	318·4	17·28	298·9	14·18	201·2	13·48	181·7	12·73	162·2	11·09	123·1	10·55	111·4	10·44	109·1	8·23	67·8
190	17·64	310·2	17·06	291·1	14·00	196·0	13·30	177·1	12·57	158·1	10·95	120·0	10·42	108·6	10·31	106·3	8·13	66·2
195	17·39	302·4	16·84	283·8	13·83	191·2	13·14	172·7	12·41	154·2	10·82	117·1	10·29	106·0	10·18	103·8	8·04	64·6
200	17·17	295·0	16·64	276·9	13·66	186·6	12·98	168·5	12·26	150·5	10·69	114·3	10·17	103·5	10·06	101·3	7·95	63·2
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{32}$ inch thick.

TABLE No. 311.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	19·42	377·2	18·81	354·0	15·42	238·0	14·65	214·8	13·84	191·6	12·05	145·2	11·45	131·2	11·33	128·5	8·91	79·5
170	19·13	366·2	18·54	343·7	15·20	231·1	14·44	208·6	13·64	186·1	11·87	141·1	11·29	127·5	11·17	124·8	8·79	77·3
175	18·86	356·0	18·28	334·1	14·99	224·7	14·24	202·8	13·45	181·0	11·71	137·2	11·14	124·1	11·02	121·5	8·67	75·3
180	18·60	346·2	18·02	325·0	14·78	218·6	14·05	197·4	13·27	176·1	11·55	133·6	10·99	120·8	10·87	118·2	8·56	73·3
185	18·36	337·0	17·78	316·3	14·59	212·9	13·86	192·2	13·09	171·5	11·40	130·1	10·85	117·7	10·73	115·2	8·45	71·5
190	18·12	328·3	17·55	308·2	14·40	207·4	13·68	187·3	12·93	167·1	11·26	126·8	10·71	114·7	10·60	112·3	8·35	69·8
195	17·89	320·1	17·33	300·4	14·22	202·3	13·51	182·6	12·77	163·0	11·12	123·7	10·58	112·0	10·47	109·6	8·25	68·1
200	17·67	312·2	17·12	293·1	14·05	197·4	13·35	178·2	12·61	159·1	10·99	120·8	10·45	109·3	10·34	107·0	8·16	66·6
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{16}$ inch thick.

TABLE No. 312.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	19·96	398·7	19·34	374·1	15·85	251·4	15·06	226·9	14·22	202·3	12·38	153·2	11·77	138·5	11·64	135·6	9·15	83·7
170	19·67	387·1	19·06	363·3	15·62	244·2	14·84	220·4	14·02	196·5	12·20	148·9	11·60	134·6	11·48	131·7	9·02	81·4
175	19·39	376·2	18·79	353·1	15·40	237·4	14·63	214·2	13·82	191·1	12·03	144·8	11·44	130·9	11·32	128·1	8·90	79·3
180	19·13	366·0	18·53	343·5	15·19	231·0	14·43	208·5	13·63	186·0	11·87	141·0	11·29	127·5	11·17	124·8	8·79	77·2
185	18·87	356·2	18·28	334·3	14·99	224·9	14·24	203·0	13·45	181·1	11·72	137·3	11·14	124·2	11·02	121·5	8·68	75·3
190	18·63	347·0	18·04	325·7	14·80	219·1	14·06	197·8	13·28	176·5	11·57	133·8	11·00	121·0	10·88	118·5	8·57	73·5
195	18·39	338·3	17·82	317·5	14·61	213·6	13·89	192·9	13·12	172·1	11·42	130·6	10·87	118·1	10·75	115·6	8·47	71·7
200	18·16	330·0	17·60	309·7	14·44	208·5	13·72	188·2	12·96	168·0	11·29	127·5	10·74	115·3	10·62	112·9	8·37	70·1
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{3}{32}$ inch thick.

TABLE No. 313.

Pressure per sq. in.	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	20·51	420·8	19·87	394·9	16·28	265·2	15·47	239·3	14·61	213·4	12·71	161·5	12·08	146·0	11·95	142·9	9·38	88·1
170	20·21	408·6	19·58	383·4	16·05	257·6	15·24	232·4	14·39	207·3	12·53	156·9	11·91	141·8	11·78	138·8	9·25	85·7
175	19·92	397·1	19·30	372·6	15·82	250·4	15·03	226·0	14·19	201·5	12·35	152·6	11·74	138·0	11·62	135·0	9·13	83·4
180	19·65	386·2	19·04	362·5	15·61	243·6	14·83	219·9	14·00	196·0	12·19	148·6	11·59	134·3	11·46	131·4	9·01	81·2
185	19·39	376·0	18·78	352·8	15·40	237·2	14·63	214·1	13·82	191·0	12·03	144·7	11·44	130·8	11·31	128·1	8·90	79·2
190	19·13	366·2	18·54	343·7	15·20	231·1	14·44	208·6	13·64	186·1	11·87	141·0	11·29	127·5	11·17	124·8	8·79	77·3
195	18·89	357·0	18·30	335·0	15·01	225·3	14·26	203·4	13·47	181·5	11·73	137·6	11·15	124·4	11·03	121·8	8·69	75·5
200	18·66	348·2	18·08	326·8	14·83	219·9	14·09	198·5	13·30	177·1	11·59	134·3	11·02	121·5	10·90	118·9	8·58	73·7
	*A_1		*B_1		*C_1		*D_1		*E_1		*F_1G_1		*H_1		*r G_1		*I_1	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable ; these conditions, with their distinguishing letters, will be found on page 195 and following.

FLAT SURFACES.

Pressures, Pitches, and Surfaces.

Steel Plate $1\frac{1}{8}$ inch thick.

TABLE No. 314.

Pressure per sq. in.	$*A_1$		$*B_1$		$*C_1$		$*D_1$		$*E_1$		$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	
	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface	Pitch	Surface
lbs.	ins.	sq.ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.	ins.	sq. ins.
165	21·06	443·5	20·40	416·2	16·71	279·4	15·87	252·1	14·99	224·7	13·04	170·0	12·39	153·6	12·26	150·4	9·62	92·6
170	20·75	430·7	20·10	404·1	16·47	271·4	15·65	244·8	14·77	218·3	12·85	165·2	12·22	149·3	12·09	146·1	9·49	90·0
175	20·46	418·5	19·81	392·7	16·24	263·8	15·43	238·0	14·57	212·2	12·67	160·7	12·05	145·2	11·92	142·1	9·36	87·6
180	20·17	407·1	19·54	382·0	16·02	256·6	15·22	231·6	14·37	206·5	12·50	156·4	11·89	141·3	11·76	138·3	9·24	85·4
185	19·90	396·2	19·28	371·8	15·80	249·9	15·01	225·5	14·18	201·1	12·34	152·3	11·73	137·7	11·61	134·7	9·12	83·2
190	19·64	386·0	19·03	362·2	15·60	243·5	14·82	219·7	14·00	196·0	12·18	148·5	11·58	134·2	11·46	131·4	9·01	81·2
195	19·39	376·2	18·79	353·1	15·40	237·4	14·63	214·2	13·82	191·1	12·03	144·8	11·44	130·9	11·32	128·1	8·90	79·3
200	19·15	367·0	18·56	344·4	15·22	231·6	14·45	209·0	13·65	186·5	11·89	141·3	11·30	127·8	11·18	125·1	8·80	77·4
	$*A_1$		$*B_1$		$*C_1$		$*D_1$		$*E_1$		$*F_1G_1$		$*H_1$		$*r\ G_1$		$*I_1$	

* The distinguishing letter in each column refers to the conditions to which the pitches and surfaces are applicable; these conditions, with their distinguishing letters, will be found on page 195 and following.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on *Solid* Steel Screwed Stays, which have *not* been welded or worked in the fire, 9000 lbs. per square inch of net section.*

TABLE NO. 315.

Pressure per square inch.	Area 0·1963 sq. inch.	Area 0·2485 sq. inch.	Area 0·3068 sq. inch.	Area 0·3712 sq. inch.	Area 0·4417 sq. inch.	Area 0·5184 sq. inch.	Area 0·6013 sq. inch.	Area 0·6902 sq. inch.	Area 0·7854 sq. inch.	Area 0·8866 sq. inch.	Area 0·9940 sq. inch.	Area 1·1075 sq. inch.	Area 1·2272 sq. inch.	Area 1·3530 sq. inch.	Area 1·4049 sq. inch.
	Diam. $\frac{1}{2}$ inch.	Diam. $\frac{9}{16}$ inch.	Diam. $\frac{5}{8}$ inch.	Diam. $\frac{11}{16}$ inch.	Diam. $\frac{3}{4}$ inch.	Diam. $\frac{13}{16}$ inch.	Diam. $\frac{7}{8}$ inch.	Diam. $\frac{15}{16}$ inch.	Diam. 1 inch.	Diam. $1\frac{1}{16}$ inch.	Diam. $1\frac{1}{8}$ inch.	Diam. $1\frac{3}{16}$ inch.	Diam. $1\frac{1}{4}$ inch.	Diam. $1\frac{5}{16}$ inch.	Diam. $1\frac{3}{8}$ inch.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	...	13·5	16·7	20·2	24·0	28·2	32·7	37·6	42·8	48·3	54·2	60·4	66·9	73·8	80·9
170	...	13·1	16·2	19·6	23·3	27·4	31·8	36·5	41·5	46·9	52·6	58·6	64·9	71·6	78·6
175	...	12·7	15·7	19·0	22·7	26·6	30·9	35·4	40·3	45·5	51·1	56·9	63·1	69·5	76·3
180	...	12·4	15·3	18·5	22·0	25·9	30·0	34·5	39·2	44·3	49·7	55·3	61·3	67·6	74·2
185	...	12·0	14·9	18·0	21·4	25·2	29·2	33·5	38·1	43·1	48·3	53·8	59·7	65·8	72·2
190	...	...	14·5	17·5	20·9	24·5	28·4	32·6	37·2	41·9	47·0	52·4	58·1	64·0	70·3
195	...	...	14·1	17·1	20·3	23·9	27·7	31·8	36·2	40·9	45·8	51·1	56·6	62·4	68·5
200	...	...	13·8	16·7	19·8	23·3	27·0	31·0	35·3	39·8	44·7	49·8	55·2	60·8	66·8

* 9000 lbs. per square inch of net section is the greatest working stress to which *solid* steel screwed stays should be subjected. Steel stays which have been welded or worked in the fire are *not* reliable, and should *not* be used. See Notes page 258.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on *Solid* Steel Screwed Stays, which have *not* been welded or worked in the fire, 9000 lbs. per square inch of net section.* TABLE No. 316.

Pressure per square inch.	Area 1·6230 sq. inch.	Area 1·7671 sq. inch.	Area 1·9175 sq. inch.	Area 2·0739 sq. inch.	Area 2·2365 sq. inch.	Area 2·4053 sq. inch.	Area 2·5802 sq. inch.	Area 2·7612 sq. inch.	Area 2·9483 sq. inch.	Area 3·1416 sq. inch.	Area 3·3410 sq. inch.	Area 3·5466 sq. inch.	Area 3·7583 sq. inch.	Area 3·9761 sq. inch.	Area 4·200 sq. inch.
	Diam. 1 7/16 inch.	Diam. 1 1/2 inch.	Diam. 1 9/16 inch.	Diam. 1 5/8 inch.	Diam. 1 11/16 inch.	Diam. 1 3/4 inch.	Diam. 1 13/16 inch.	Diam. 1 7/8 inch.	Diam. 1 15/16 inch.	Diam. 2 inches.	Diam. 2 1/16 inches.	Diam. 2 1/8 inches.	Diam. 2 3/16 inches.	Diam. 2 1/4 inches.	Diam. 2 5/16 inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	88·5	96·3	104·5	113·1	121·9	131·1	140·7	150·6	160·8	171·3	182·2	193·4	204·9	216·8	229·0
170	85·9	93·5	101·5	109·7	118·4	127·3	136·5	146·1	156·0	166·3	176·8	187·7	198·9	210·5	222·3
175	83·4	90·8	98·6	106·6	115·0	123·7	132·6	142·0	151·6	161·5	171·8	182·3	193·2	204·4	216·0
180	81·1	88·3	95·8	103·6	111·8	120·2	129·0	138·0	147·4	157·0	167·0	177·3	187·9	198·8	210·0
185	78·9	85·9	93·2	100·8	108·8	117·0	125·5	134·3	143·4	152·8	162·5	172·5	182·8	193·4	204·3
190	76·8	83·7	90·8	98·2	105·9	113·9	122·2	130·7	139·6	148·8	158·2	167·9	178·0	188·3	198·9
195	74·9	81·5	88·4	95·7	103·2	111·0	119·0	127·4	136·0	144·9	154·2	163·6	173·4	183·5	193·8
200	73·0	79·5	86·2	93·3	100·6	108·2	116·1	124·2	132·6	141·3	150·3	159·5	169·1	178·9	189·0

* 9000 lbs. per square inch of net section is the greatest working stress to which *solid* steel screwed stays should be subjected. Steel stays which have been welded or worked in the fire are *not* reliable, and should *not* be used. See Notes page 258.

PRESSURES, GREATEST SURFACES AND SIZES OF STAYS.

Stress on *Solid* Steel Screwed Stays, which have *not* been welded or worked in the fire, 9000 lbs. per square inch of net section.* TABLE No. 317.

Pressure per square inch.	Area 4·4301 sq. ins.	Area 4·6664 sq. ins.	Area 4·9087 sq. ins.	Area 5·1572 sq. ins.	Area 5·4119 sq. ins.	Area 5·6727 sq. ins.	Area 5·9396 sq. ins.	Area 6·2126 sq. ins.	Area 6·4918 sq. ins.	Area 6·7771 sq. ins.	Area 7·0686 sq. ins.	Area 7·3662 sq. ins.	Area 7·6699 sq. ins.	Area 7·9798 sq. ins.	Area 8·2958 sq. ins.
	Diam. $2\frac{3}{8}$ inches.	Diam. $2\frac{7}{16}$ inches.	Diam. $2\frac{1}{2}$ inches.	Diam. $2\frac{9}{16}$ inches.	Diam. $2\frac{5}{8}$ inches.	Diam. $2\frac{11}{16}$ inches.	Diam. $2\frac{3}{4}$ inches.	Diam. $2\frac{13}{16}$ inches.	Diam. $2\frac{7}{8}$ inches.	Diam. $2\frac{15}{16}$ inches.	Diam. 3 inches.	Diam. $3\frac{1}{16}$ inches.	Diam. $3\frac{1}{8}$ inches.	Diam. $3\frac{3}{16}$ inches.	Diam. $3\frac{1}{4}$ inches.
lbs.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.	Surface sq. ins.
165	241·6	254·5	267·7	281·3	295·1	309·4	323·9	338·8	354·0	369·6	385·5	401·7	418·3	435·2	452·4
170	234·5	247·0	259·8	273·0	286·5	300·3	314·4	328·9	343·6	358·7	374·2	389·9	406·0	422·4	439·1
175	227·8	239·9	252·4	265·2	278·3	291·7	305·4	319·5	333·8	348·5	363·5	378·8	394·4	410·3	426·6
180	221·5	233·3	245·4	257·8	270·5	283·6	296·9	310·6	324·5	338·8	353·4	368·3	383·4	398·9	414·7
185	215·5	227·0	238·8	250·8	263·2	275·9	288·9	302·2	315·8	329·6	343·8	358·3	373·1	388·2	403·5
190	209·8	221·0	232·5	244·2	256·3	268·7	281·3	294·2	307·5	321·0	334·8	348·9	363·3	377·9	392·9
195	204·4	215·3	226·5	238·0	249·7	261·8	274·1	286·7	299·6	312·7	326·2	339·9	353·9	368·2	382·8
200	199·3	209·9	220·8	232·0	243·5	255·2	267·2	279·5	292·1	304·9	318·0	331·4	345·1	359·0	373·3

* 9000 lbs. per square inch of net section is the greatest working stress to which *solid* steel screwed stays should be subjected. Steel stays which have been welded or worked in the fire, are *not* reliable and should *not* be used. See Notes page 258.

STEEL GIRDERS ½ INCH THICK. TABLE No. 318.

Pressure per sq. in.	Depths of Girders in inches.								
	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾
lbs.									
165	...	...	...	...	...	...	...	...	562
170	...	...	...	...	...	...	...	...	545
175	...	...	...	...	...	...	...	...	530
180	...	...	...	...	...	...	...	...	515
185	...	...	...	...	...	...	...	...	501
190	...	...	...	...	...	...	...	...	...
195	...	...	...	...	...	...	...	...	...
200	...	...	...	...	...	...	...	...	...

STEEL GIRDERS ⅝ INCH THICK. TABLE No. 319.

Pressure per sq. in.	Depths of Girders in inches.								
	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼
lbs.									
165	...	...	...	...	528	612	703	800	903
170	...	...	...	...	512	594	682	776	876
175	...	...	...	...	...	577	662	754	851
180	...	...	...	...	...	561	644	733	827
185	...	...	...	...	...	546	627	713	805
190	...	...	...	...	...	531	610	694	784
195	...	...	...	...	...	518	594	676	764
200	...	...	...	...	...	505	580	660	745

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches. See Notes on pages 264 and 265.

STEEL GIRDERS $\frac{3}{4}$ INCH THICK. TABLE No. 320.

Pressure per sq. in.	Depths of Girders in inches.								
	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾
lbs. 165	...	540	633	735	843	960	1083	1215	1353
170	...	524	615	713	818	931	1051	1179	1313
175	...	509	597	693	795	905	1021	1145	1276
180	...	...	580	673	773	880	993	1113	1240
185	...	...	565	655	752	856	966	1083	1207
190	...	...	550	638	732	833	941	1055	1175
195	...	...	536	621	713	812	917	1028	1145
200	...	...	522	606	696	792	894	1002	1116

STEEL GIRDERS $\frac{7}{8}$ INCH THICK. TABLE No. 321.

Pressure per sq. in.	Depths of Girders in inches.								
	3½	3¾	4	4¼	4½	4¾	5	5¼	5½
lbs. 165	857	984	1120	1264	1417	1579	1750	1929	2117
170	832	955	1087	1227	1375	1532	1698	1872	2055
175	808	928	1056	1192	1336	1489	1650	1819	1996
180	786	902	1026	1159	1299	1447	1604	1768	1941
185	764	877	998	1127	1264	1408	1560	1720	1888
190	744	854	972	1098	1230	1371	1519	1673	1838
195	725	832	947	1069	1199	1336	1480	1632	1791
200	707	812	924	1043	1169	1302	1443	1591	1746

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches. See Notes on pages 264 and 265.

STEEL GIRDERS 1 INCH THICK. TABLE No. 322.

Pressure per sq. in.	Depths of Girders in inches.								
	4¼	4½	4¾	5	5¼	5½	5¾	6	6¼
lbs.									
165	1445	1620	1805	2000	2205	2420	2645	2880	3125
170	1402	1572	1751	1941	2140	2348	2567	2795	3033
175	1362	1527	1701	1885	2079	2281	2493	2715	2946
180	1324	1485	1654	1873	2021	2218	2424	2640	2864
185	1288	1444	1609	1783	1966	2158	2359	2568	2787
190	1254	1406	1567	1736	1914	2101	2296	2501	2713
195	1222	1370	1527	1692	1865	2047	2238	2436	2644
200	1192	1336	1489	1650	1819	1996	2182	2376	2578

STEEL GIRDERS $1\frac{1}{8}$ INCH THICK. TABLE No. 323.

Pressure per sq. in.	Depths of Girders in inches.								
	5	5¼	5½	5¾	6	6¼	6½	6¾	7
lbs.									
165	2250	2480	2722	2975	3240	3515	3802	4100	4410
170	2183	2407	2642	2888	3144	3412	3690	3980	4280
175	2121	2338	2566	2805	3054	3314	3585	3866	4158
180	2062	2273	2495	2727	2970	3222	3485	3758	4042
185	2006	2212	2428	2653	2889	3135	3391	3657	3933
190	1953	2154	2364	2584	2813	3053	3302	3561	3829
195	1903	2098	2303	2517	2741	2974	3217	3469	3731
200	1856	2046	2246	2454	2673	2900	3137	3383	3638

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches. See Notes on pages 264 and 265.

STEEL GIRDERS $1\frac{1}{4}$ INCH THICK. TABLE No. 324.

Pressure per sq. in.	Depths of Girders in inches.								
	5¾	6	6¼	6½	6¾	7	7¼	7½	7¾
lbs. 165	3306	3600	3906	4225	4556	4900	5256	5625	6006
170	3209	3494	3791	4100	4422	4755	5101	5459	5829
175	3117	3394	3683	3983	4295	4620	4955	5303	5663
180	3030	3300	3580	3872	4176	4491	4818	5156	5505
185	2948	3210	3483	3768	4063	4370	4688	5016	5357
190	2871	3126	3392	3669	3956	4255	4564	4884	5215
195	2797	3046	3305	3575	3855	4146	4447	4759	5082
200	2727	2970	3222	3485	3758	4042	4336	4640	4955

STEEL GIRDERS $1\frac{3}{8}$ INCH THICK. TABLE No. 325.

Pressure per sq. in.	Depths of Girders in inches.								
	6½	6¾	7	7¼	7½	7¾	8	8¼	8½
lbs. 165	4647	5011	5390	5781	6187	6606	7040	7486	7947
170	4510	4864	5231	5611	6005	6412	6832	7266	7713
175	4381	4725	5082	5451	5833	6229	6637	7059	7493
180	4260	4594	4940	5300	5671	6056	6453	6862	7285
185	4145	4470	4807	5156	5518	5892	6278	6677	7088
190	4035	4352	4680	5021	5373	5737	6113	6501	6901
195	3932	4240	4560	4892	5235	5590	5956	6335	6724
200	3834	4134	4446	4770	5104	5450	5808	6176	6556

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches. See Notes on pages 264 and 265.

STEEL GIRDERS $1\frac{1}{2}$ INCH THICK. TABLE No. 326.

Pressure per sq. in.	Depths of Girders in inches.								
	7¼	7½	7¾	8	8¼	8½	8¾	9	9¼
lbs.									
165	6307	6750	7207	7680	8167	8670	9187	9720	10267
170	6121	6551	6995	7454	7927	8415	8917	9434	9965
175	5947	6364	6795	7241	7700	8174	8662	9164	9680
180	5781	6187	6606	7040	7486	7947	8421	8910	9411
185	5625	6020	6428	6849	7284	7732	8194	8669	9157
190	5477	5861	6259	6669	7092	7529	7978	8441	8916
195	5307	5711	6098	6498	6910	7336	7774	8224	8687
200	5203	5568	5946	6336	6738	7152	7579	8019	8470

STEEL GIRDERS $1\frac{5}{8}$ INCH THICK. TABLE No. 327.

Pressure per sq. in.	Depths of Girders in inches.								
	8	8¼	8½	8¾	9	9¼	9½	9¾	10
lbs.									
165	8320	8848	9392	9953	10530	11123	11732	12358	13000
170	8075	8587	9116	9660	10220	10795	11387	11994	12617
175	7844	8342	8855	9384	9928	10487	11062	11651	12257
180	7626	8110	8609	9123	9652	10196	10754	11323	11916
185	7420	7891	8377	8877	9391	9920	10464	11022	11594
190	7225	7683	8156	8643	9144	9659	10188	10732	11289
195	7040	7486	7947	8421	8910	9411	9927	10456	11000
200	6864	7299	7748	8211	8687	9176	9679	10195	10725

In the above Tables, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.

D = Distance between centres of girders in inches.

P = Pitch of supporting bolts in inches. See Notes on pages 264 and 265.

STEEL GIRDERS $1\frac{3}{4}$ INCH THICK. TABLE No. 328.

Pressure per sq. in.	Depths of Girders in inches.								
	8¾	9	9¼	9½	9¾	10	10¼	10½	10¾
lbs.									
165	10718	11340	11978	12635	13308	14000	14708	15435	16178
170	10403	11006	11626	12263	12917	13588	14276	14981	15702
175	10106	10692	11294	11913	12548	13200	13868	14553	15254
180	9825	10395	10980	11582	12199	12833	13483	14148	14830
185	9559	10114	10683	11269	11869	12486	13118	13766	14429
190	9308	9847	10402	10972	11557	12157	12773	13404	14049
195	9069	9595	10135	10691	11261	11846	12445	13060	13689
200	8832	9355	9882	10423	10979	11550	12134	12733	13347

In the above Table, when the number of supporting bolts in a girder is *odd*, the number under the particular depth of girder equals W^2D; but when the number of bolts is *even*, it equals $(W^2 - P^2)D$. When the exact value or number is not found under the given depth, the next greater number in the same column is the number, opposite which will be found the working pressure in column 1.

W = Width of combustion box in inches.
D = Distance between centres of girders in inches.
P = Pitch of supporting bolts in inches. See Notes on pages 264 and 265.

FURNACES PLAIN CYLINDRICAL.

Steel Plates.

Pressures and Numerals for Lengths and Diameters.

Steel Plates $\frac{1}{4}$ inch thick. Table No. 329.									Steel Plates $\frac{9}{32}$ inch thick. Table No. 330.								
Pressure per sq. in.	Numerals.							Maximum Diam.*	Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N			A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.	lbs.								ins.
165	37·5	35·4	33·3	31·2	29·2	27·1	25·0	15	165	47·5	44·8	42·2	39·6	36·9	34·3	31·6	16·87
170	36·4	34·4	32·4	30·3	28·3	26·3	24·3	14 55	170	46·1	43·5	40·9	38·4	35·8	33·3	30·7	16·37
175	35·4	33·4	31·4	29·5	27·5	25·5	23·6	14·14	175	44·7	42·3	39·8	37·3	34·8	32·3	29·8	15·91
180	34·4	32·5	30·6	28·6	26·7	24·8	22·9	13·75	180	43·5	41·1	38·7	36·3	33·8	31·4	29·0	15·46
185	33·4	31·6	29·7	27·9	26·0	24·2	22·3	13·37	185	42·3	40·0	37·6	35·3	32·9	30·6	28·2	15·05
190	32·6	30·8	28·9	27·1	25·3	23·5	21·7	13·02	190	41·2	38·9	36·6	34·3	32·1	29·8	27·5	14·65
195	31·7	30·0	28·2	26·4	24·7	22·9	21·2	12·69	195	40·2	37·9	35·7	33·5	31·2	29·0	26·8	14·27
200	30·9	29·2	27·5	25·8	24·1	22·3	20·6	12·37	200	39·2	37·0	34·8	32·6	30·5	28·3	26·1	13·92

The length **L** should never exceed 10 feet and $\frac{N}{D}-1$ **should not be more than 10 feet.**

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure **in this table, but** *may be less.* See notes, pages 320 to 324.

† When A1 is the distinguishing letter Tab'e No. 342 may be used when the length does not exceed for $\frac{1}{4}$ inch, 1·5 feet and, for $\frac{9}{32}$ inch, 1·812 feet.

The numeral **N** should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D}-1=L$. $\frac{N}{L+1}=D$. $(L+1)\,D=N$.

FURNACES PLAIN CYLINDRICAL.

Steel Plates.

Pressures and Numerals for Lengths and Diameters.

Steel Plates $\frac{5}{16}$ inch thick. TABLE No. 331.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	58·6	55·3	52·1	48·8	45·6	42·3	39·1	18·75
170	56·9	53·7	50·7	47·4	44·2	41·1	37·9	18·19
175	55·2	52·2	49·1	46·0	43·0	39·9	36·8	17·67
180	52·7	50·7	47·7	44·8	41·8	38·8	35·8	17·18
185	52·3	49·4	46·5	43·5	40·6	37·7	34·8	16·72
190	50·9	48·1	45·2	42·4	39·6	36·7	33·9	16·28
195	49·6	46·8	44·1	41·3	38·6	35·8	33·1	15·86
200	48·3	45·7	43·0	40·3	37·6	34·9	32·2	15·46

Steel Plates $\frac{11}{32}$ inch thick. TABLE No. 332.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	70·9	67·0	63·0	59·1	55·1	51·2	47·3	20·62
170	68·8	65·0	61·2	57·3	53·5	49·7	45·9	20·01
175	66·8	63·1	59·4	55·7	52·0	48·3	44·6	19 44
180	65·0	61·4	57·8	54·2	50·5	46·9	43·3	18·90
185	63·2	59·7	56·2	52·7	49·2	45·7	42·2	18·39
190	61·6	58·1	54·7	51·3	47·9	44·5	41·0	17·91
195	60·0	56·7	53·3	50·0	46·7	43·3	40·0	17·45
200	58·5	55·2	52·0	48·7	45·5	42·2	39·0	17·01

The length L should never exceed 10 feet and $\frac{N}{D}-1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.* See notes, pages 320 to 324.

† When A1 is the distinguishing letter Table No. 342 may be used when the length does not exceed for $\frac{5}{16}$ inch, 2·125 feet and, for $\frac{11}{32}$ inch, 2·437 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D}-1=L.$ $\frac{N}{L+1}=D.$ $(L+1)\,D=N.$

FURNACES PLAIN CYLINDRICAL.

Steel Plates.

Pressures and Numerals for Lengths and Diameters.

Steel Plates $\frac{3}{8}$ inch thick. TABLE No. 333.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	84·4	79·7	75·0	70·3	65·6	60·9	56·2	22·50
170	81·9	77·3	72·8	68·2	63·7	59·1	54·6	21·83
175	79·6	75·1	70·7	66·3	61·9	57·5	53·0	21·21
180	77·3	73·0	68·8	64·5	60·2	55·9	51·6	20·62
185	75·3	71·1	66·9	62·7	58·5	54·3	50·2	20·06
190	73·3	69·2	65·1	61·1	57·0	52·9	48·8	19·53
195	71·4	67·4	63·5	59·5	55·5	51·6	47·6	19·03
200	69·6	63·7	61·9	58·0	54·1	50·7	46·4	18·56

Steel Plates $\frac{13}{32}$ inch thick. TABLE No. 334.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	99·0	93·5	88·0	82·5	77·0	71·5	66·0	24·37
170	96·1	90·8	85·4	80·1	74·8	69·4	64·1	23·65
175	93·4	88·2	83·0	77·8	72·6	67·4	62·2	22·98
180	90·8	85·7	80·7	75·6	70·6	65·6	60·5	22·34
185	88·3	83·4	78·5	73·6	68·7	63·8	58·9	21·73
190	86·0	81·2	76·4	71·7	66·9	62·1	57·3	21·16
195	83·8	79·1	74·5	69·8	65·2	60·5	55·9	20·62
200	81·7	77·2	72·6	68·1	63·5	59·0	54·5	20·10

The length L should never exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*. See notes, pages 320 to 324.

† When A1 is the distinguishing letter Table No. 342 may be used when the length does not exceed for $\frac{3}{8}$ inch, 2·75 feet and, for $\frac{13}{32}$ inch, 3·062 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L$. $\frac{N}{L+1} = D$. $(L+1)\ D = N$.

FURNACES PLAIN CYLINDRICAL.

Steel Plates.

Pressures and Numerals for Lengths and Diameters.

Steel Plates $\frac{7}{16}$ inch thick. TABLE No. 335.

Pressure per sq. in.	A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	115	108	102	95·7	89·3	82·9	75·6	26·25
170	111	105	99·1	92·9	86·7	80·5	74·3	25·47
175	108	102	96·3	90·2	84·2	78·2	72·2	24·75
180	105	99·4	93·6	87·7	81·9	76·0	70·2	24·06
185	102	96·7	91·0	85·4	79·7	74·0	68·3	23·41
190	99·7	94·2	88·7	83·1	77·6	72·0	66·5	22·79
195	97·2	91·8	86·4	81·0	75·6	70·2	64·8	22·21
200	94·7	89·5	84·2	79·0	73·7	68·4	63·2	21·65

Steel Plates $\frac{15}{32}$ inch thick. TABLE No. 336.

Pressure per sq. in.	A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	132	125	117	110	103	95·2	87·9	28·12
170	128	121	114	107	99·5	92·4	85·3	27·29
175	124	117	110	104	96·7	89·8	82·9	26·51
180	121	114	107	101	94·1	87·3	80·6	25·78
185	118	111	105	98·0	91·5	84·9	78·4	25·08
190	114	108	102	95·4	89·0	82·7	76·3	24·42
195	112	105	99·2	93·0	86·8	80·6	74·4	23·79
200	109	103	96·7	90·6	84·6	78·6	72·5	23·20

The length L should never exceed 10 feet and $\frac{N}{D}-1$ should **not** be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.* See notes, pages 320 to 324.

† When A1 is the distinguishing letter Table No. 342 may be used when the length does not exceed for $\frac{7}{16}$ inch, 3·375 feet and, for $\frac{15}{32}$ inch, 3·687 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches.

N = Numeral applicable to the case.

L = Length of furnace in feet.

$\frac{N}{D}-1=L.$ $\frac{N}{L+1}=D.$ $(L+1)\,D=N.$

FURNACES PLAIN CYLINDRICAL.

Steel Plates.

Pressures and Numerals for Lengths and Diameters.

Steel Plates $\frac{1}{2}$ inch thick. TABLE No. 337.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	150	142	133	125	117	108	100	30·00
170	146	138	129	121	113	105	97·1	29·11
175	141	134	126	118	110	102	94·3	28·28
180	138	130	122	115	107	99·3	91·7	27·50
185	134	126	119	111	104	96·6	89·2	26·75
190	130	123	116	109	101	94·1	86·8	26·05
195	127	120	113	106	98·7	91·7	84·6	25·38
200	124	117	110	103	96·3	89·4	82·5	24·75

Steel Plates $\frac{17}{32}$ inch thick. TABLE No. 338.

Pressure per sq. in.	Numerals. A1†A N	B N	C N	D N	E N	F N	G N	Maximum Diam.*
lbs.								ins.
165	169	160	151	141	132	122	113	31·87
170	164	155	146	137	128	119	110	30·93
175	160	151	142	133	124	115	106	30·05
180	155	147	138	129	121	112	103	29·21
185	151	143	134	126	117	109	101	28·42
190	147	139	131	123	114	106	98·0	27·68
195	143	135	127	119	111	103	95·5	26·97
200	140	132	124	116	109	101	93·1	26·29

The length L should never exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*. See notes, pages 320 to 324.

† When A1 is the distinguishing letter Table No. 342 may be used when the length does not exceed for $\frac{1}{2}$ inch, 4 feet and, for $\frac{17}{32}$ inch, 4·312 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L$. $\frac{N}{L+1} = D$. $(L+1)\,D = N$

FURNACES PLAIN CYLINDRICAL.

Steel Plates.

Pressures and Numerals for Lengths and Diameters.

Steel Plates $\frac{9}{16}$ inch thick. Table No. 339.									Steel Plates $\frac{19}{32}$ inch thick. Table No. 340.								
Pressure per sq. in.	Numerals.							Maximum Diam.*	Pressure per sq. in.	Numerals.							Maximum Diam.*
	A1†A N	B N	C N	D N	E N	F N	G N			A1†A N	B N	C N	D N	E N	F N	G	
lbs.								ins.	lbs.								ins.
165	190	179	169	158	148	137	127	33·75	165	212	200	188	176	165	153	141	35·62
170	184	174	164	154	143	133	123	32·75	170	205	194	183	171	160	148	137	34·57
175	179	169	159	149	139	129	119	31·82	175	199	188	177	166	155	144	133	33·58
180	174	164	155	145	135	126	116	30·93	180	194	183	172	162	151	140	129	32·65
185	169	160	151	141	132	122	113	30·10	185	189	178	168	157	147	136	126	31·77
190	165	156	147	137	128	119	110	29·30	190	184	173	163	153	143	133	122	30·93
195	161	152	143	134	125	116	107	28·55	195	179	169	159	149	139	129	119	30·14
200	157	148	139	131	122	113	104	27·84	200	175	165	155	145	136	126	116	29·39

The length L should never exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less*. See notes, pages 320 to 324.

† When A1 is the distinguishing letter Table No. 342 may be used when the length does not exceed for $\frac{9}{16}$ inch, 4·625 feet and, for $\frac{19}{32}$ inch, 4·937 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\,D = N.$

FURNACES PLAIN CYLINDRICAL.

Steel Plates.

Pressures and Numerals for Lengths and Diameters.

Steel Plates $\frac{5}{8}$ inch thick. TABLE No. 341.

Pressure per sq. in.	Numerals.							Maximum Diameter.*
	A1†A N	B N	C N	D N	E N	F N	G N	
lbs.								ins.
165	234	221	208	195	182	169	156	37·50
170	227	215	202	190	177	164	152	36·39
175	221	209	196	184	172	160	147	35·35
180	215	203	191	179	167	155	143	34·37
185	209	197	186	174	163	151	139	33·44
190	204	192	181	170	158	147	136	32·56
195	198	187	176	165	154	143	132	31·73
200	193	183	172	161	150	140	130	30·93

The length L should never exceed 10 feet and $\frac{N}{D} - 1$ should not be more than 10 feet.

* The diameter D should *not* be greater for any given pressure than that opposite the given pressure in this table, but *may be less.* See notes, pages 320 to 324.

† When A1 is the distinguishing letter Table No. 342 may be used when the length does not exceed 5·25 feet.

The numeral N should always be taken from the column under the distinguishing letter applicable to the case and opposite the given pressure.

D = Diameter of furnace in inches. N = Numeral applicable to the case.

L = Length of furnace in feet. $\frac{N}{D} - 1 = L.$ $\frac{N}{L+1} = D.$ $(L+1)\, D = N.$

FURNACES WITH FLANGED JOINTS.

Steel Plates from $\frac{1}{4}$ inch to $\frac{5}{8}$ inch thick.

Pressure per sq. in.	Pressure Numerals.	Thickness.	Constants.	*Maximum Lengths for Thickness in inches.
lbs.	N.	inches.	C.	
		¼	63·0	18·0
		9/32	72·375	21·75
165	3·0	5/16	81·75	25·50
170	3·0909090	11/32	91·125	29·25
175	3·1818181	⅜	100·50	33·0
180	3·2727272	13/32	109·875	36·75
185	3·3636363	7/16	119·25	40·50
190	3·4545454	15/32	128·625	44·25
195	3·5454545	½	138·0	48·0
200	3·6363636	17/32	147·375	51·75
		9/16	156·75	55·50
		19/32	166·125	59·25
		⅝	175·50	63·0

Constants and Maximum Lengths for the Thicknesses which they are opposite.

* The lengths opposite the thickness in each case are the maximum lengths, in inches, between the centres of the flanges, for which the tables should be used. When the length exceeds that opposite the given thickness then the pressure may be found from the Tables Nos. 329 to 341.

N = Pressure numeral. C = Thickness constant. D = Diameter, outside, in inches. l = Length between centres of flanges, in inches. See notes, page 338 and following.

$$\frac{C-l}{N}=D. \qquad C-ND=l. \qquad ND+l=C. \qquad \frac{C-l}{D}=N.$$

FURNACES, CORRUGATED, CYLINDRICAL.

Steel Plates from $\frac{1}{4}$ inch to $\frac{5}{8}$ inch thick.

Pressures and Diameters when *machine* made. TABLE NO. 343.

Pressure per square inch.	Thicknesses and Diameters.*												
	¼ in.	9/32 in.	5/16 in.	11/32 in.	⅜ in.	13/32 in.	7/16 in.	15/32 in.	½ in.	17/32 in.	9/16 in.	19/32 in.	⅝ in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs.													
165	21·21	23·86	26·51	29·16	31·81	34·46	37·12	39·77	42·42	45·07	47·72	50·37	53·03
170	20·58	23·16	25·73	28·30	30·88	33·45	36·02	38·60	41·17	43·75	46·32	48·89	51·47
175	20·00	22·50	25·00	27·50	30·00	32·50	35·00	37·50	40·00	42·50	45·00	47·50	50·00
180	19·44	21·87	24·30	26·73	29·16	31·59	34·02	36·45	38·88	41·31	43·75	46·18	48·61
185	18·91	21·28	23·64	26·01	28·37	30·74	33·10	35·47	37·83	40·20	42·56	44·93	47·29
190	18·42	20·72	23·02	25·32	27·63	29·93	32·23	34·53	36·84	39·14	41·44	43·75	46·05
195	17·94	20·19	22·43	24·67	26·92	29·16	31·41	33·65	35·89	38·14	40·38	42·62	44·87
200	17·50	19·68	21·87	24·06	26·25	28·43	30·62	32·81	35·00	37·18	39·37	41·56	43·75

* The diameter is measured at the bottom of the corrugations outside. See notes, page 343 and following.

FURNACES WITH RIBBED PROJECTIONS, GROOVED INSIDE.

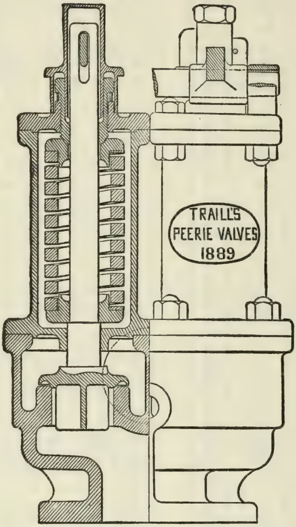
Steel Plates from $\frac{1}{4}$ inch to $\frac{5}{8}$ inch thick.

Pressures and Diameters.*

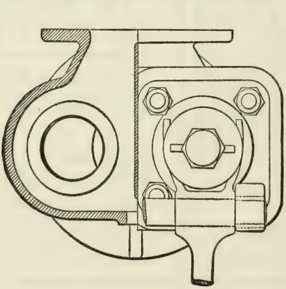
TABLE No. 344.

Pressure per square inch.	Thicknesses and Diameters.												
	¼ in.	9/32 in.	5/16 in.	11/32 in.	⅜ in.	13/32 in.	7/16 in.	15/32 in.	½ in.	17/32 in.	9/16 in.	19/32 in.	⅝ in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs. 165	21·21	23·86	26·51	29·16	31·81	34·46	37·12	39·77	42·42	45·07	47·72	50·37	53·03
170	20·58	23·16	25·73	28·30	30·88	33·45	36·02	38·60	41·17	43·75	46·32	48·89	51·47
175	20·00	22·50	25·00	27·50	30·00	32·50	35·00	37·50	40·00	42·50	45·00	47·50	50·00
180	19·44	21·87	24·30	26·73	29·16	31·59	34·02	36·45	38·88	41·31	43·75	46·18	48·61
185	18·91	21·28	23·64	26·01	28·37	30·74	33·10	35·47	37·83	40·20	42·56	44·93	47·29
190	18·42	20·72	23·02	25·32	27·63	29·93	32·23	34·53	36·84	39·14	41·44	43·75	46·05
195	17·94	20·19	22·43	24·67	26·92	29·16	31·41	33·65	35·89	38·14	40·38	42·62	44·87
200	17·50	19·68	21·87	24·06	26·25	28·43	30·62	32·81	35·00	37·18	39·37	41·56	43·75

* When the height of the ribs above the plain parts is not less than 1 5/16 inch, the depth of the grooves not greater than ¾ inch, the length not greater than 9 inches between the centres of the ribs, and the plain parts at the ends not longer than 6 inches. See notes, page 347 and following.



PEERIE 2 INCH SPRING SAFETY VALVES, GUN METAL CHESTS, SPRING CASES & FITTINGS.



SAFETY VALVES.

The PEERIE 2 inch Gun Metal Valves.

The design, of which an illustration is given on the page *immediately preceding*, was got up expressly to meet cases where it is desirable to have valves which are snug and efficient and also out of the control of those who might wish to extra load the valves, or even to accidentally do so, when steam is up. In certain cases safety valves are required by Act of Parliament to be so constructed and arranged that they are out of the control of those in charge of the boiler when steam is up; the load on these valves cannot be altered unless a lock is opened, and are as snug and compact, if not more so, than such valves generally are.

For the purpose of distinguishing the design from others it has been called the PEERIE, which means little, small, snug, &c.

The dimensions which follow will be of service to draughtsmen and others who wish to make working drawings or construct such 2 inch valves; the dimensions given are intended for pressures up to 160 lbs. per square inch, provided the combined area of the two valves is *not less* than found sufficient by the use of the Table No. 205, page 401, for the pressure and grate surface.

If the pressure exceeds 160 lbs., and is not over 200 lbs., the diameters of the spindles should be increased one-sixteenth of an inch, the breadth of the cotters being one-sixteenth of an inch, and the thickness one-thirty-second of an inch greater.

The size of the springs should always be regulated, so as to be suitable for the particular pressure by the formulæ on pages 414 and 415.

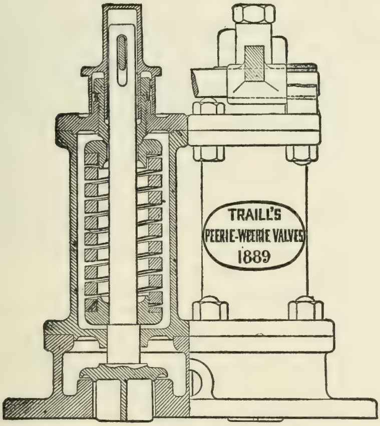
	ins.
Total height *over all*, ...	16⅛
Diameter of valves, ...	2
Diameter of *inlet*, ...	2⅞
Diameter of *outlet*, ...	3
Diameter of flange of *outlet*, ...	6⅛
Thickness of flange of *outlet*, ...	⅜
Height of chest *below* valves, *inside* at centre of chest, . .	2¾
Length of chest *below* valves, *inside*, ...	7¼
Width of chest *below* valves, *inside*, ...	3
Thickness of chest *below* valves, ...	7/16
Length of chest *above* valves, *inside*, ...	8⅛
Width of chest *above* valves, *inside*, ...	4
Thickness of chest *above* valves, ...	¼
Total height of valve chest, ...	5¾
Diameter of *bottom* flange of chest, ...	7
Thickness of *bottom* flange of chest, ...	⅝
Width of *top* flange of chest, ...	5

2 inch Gun Metal "PEERIE" Safety Valves.

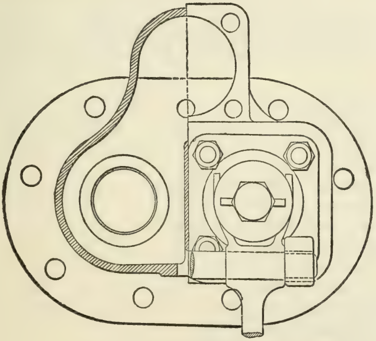
	ins.
Thickness of *top* flange of chest,	½
Height of spring case,	6⅜
Diameter of spring case, *inside*,	3
Thickness of spring case,	$^3/_{16}$
Width of *bottom* flange of spring case,	5
Thickness of *bottom* flange of spring case,	½
Width of *top* flange of spring case,	4⅛
Thickness of *top* flange of spring case,	½
Width of flange of *cover* of spring case,	4⅛
Thickness of flange of *cover* of spring case,	½
Distance between *centres* of valves,	4⅛
Diameter of *body* of spindle,	⅞
Length of *body* of spindle,	9⅜
Diameter of *lower* part of spindle,	1$^1/_{16}$
Clearance at *top* of spindle,	½
Lift of valve,	½
Length of *guide* of hood,	1½
Breadth of cotter,	1$^1/_{16}$
Thickness of cotter,	$^7/_{32}$
Length of thread of compressing screw,	1⅜
Diameter of compressing screw,	1½
Depth of thread (or part screwed) in *top cover* for compressing screw,	1⅛
Diameter of bolts for *bottom* flange of chest,	⅝
Number of bolts for *bottom* flange of chest,	six
Diameter of bolts and studs for spring case at *top*,	½
Diameter of bolts or studs for spring case at *bottom*,	⅝
Number of bolts or studs in each flange of spring case,	four
Diameter of drain pipe,	¾
Length of lifting lever,	2
Diameter of easing gear shaft,	⅞

The bolts, studs, easing gear shaft, and lifting lever should be of wrought iron.

While the Peerie design just dealt with can hold its own, as regards snugness, combined with efficiency, with other 2 inch valves of the same type, should it be necessary or desirable to adopt still snugger and lighter valves it may be done by using those made from the design and particulars given of the Peerie-Weerie valves which immediately follow.



PEERIE-WEERIE 2 INCH SPRING SAFETY VALVES, GUN METAL CHESTS, SPRING CASES & FITTINGS.



SAFETY VALVES.

The PEERIE-WEERIE 2 inch Gun Metal Valves.

It has been found that the usual designs (although there are many good ones) are not as snug as is desirable, or as they might be for small boilers, which must be placed where there is not much available space for boiler fittings, more particularly when the safety valves had to comply with Statutory regulations ; those, of which an illustration is given in the page *immediately preceding* this, have been specially arranged so as to be efficient, and in every respect to comply with the Statutory requirements for 2 inch safety valves, and is generally more compact and snugger than those designs which have come under the Author's observations, provided they were efficient, and in every respect were such as were in accordance with the requirements of the Act of Parliament for valves which have to be out of the control of those in charge of the boilers when steam is up.

This design has been called the PEERIE-WEERIE to distinguish it from other designs which are of a particularly snug description. PEERIE-WEERIE signifies, very small, very snug, &c.

The dimensions which follow will facilitate getting out drawings or constructing such 2 inch valves, and are intended for pressures up to 160 lbs. per square inch, provided the combined area of the two valves *is not* less than found sufficient by the use of the Table No. 205, p. 401, for the pressure and grate surface.

When the pressure is over 160 lbs., and not exceeding 200 lbs., the diameter of the spindles should be increased one-sixteenth of an inch, the breadth of the cotters one-sixteenth, and the thickness one-thirty-second of an inch greater.

The dimensions, &c., of the springs should in all cases be regulated to suit the pressure by the formulæ given on pp. 414 and 415.

	ins.
Total height *over all*, ...	13
Diameter of valves, ...	2
Diameter of *inlet*, ...	2⅞
Diameter of *outlet*, ...	3
Length and breadth of flange of *outlet*, ...	4
Thickness of flange of *outlet*, ...	½
Length of chest *above* valves, *inside*, ...	8⅛
Width of chest *above* valves, *inside*, ...	4
Thickness of chest *above* valves, ...	¼
Total height of valve chest, ...	2 9/16
Length of *bottom* flange of chest, ...	11⅞
Breadth of *bottom* flange of chest, ...	7¾
Thickness of *bottom* flange of chest, ...	⅝
Width of *top* flange of chest, ...	5

2 inch Gun Metal "PEERIE-WEERIE" Safety Valves.

	ins.
Thickness of *top* flange of chest,	½
Height of spring case,	6⅜
Diameter of spring case, *inside*,	3
Thickness of spring case,	3/16
Width of *bottom* flange of spring case,	5
Thickness of *bottom* flange of spring case,	½
Width of *top* flange of spring case,	4⅛
Thickness of *top* flange of spring case,	½
Width of flange of cover of spring case,	4⅛
Thickness of flange of cover of spring case,	½
Distance between centres of valves,	4⅛
Diameter of *body* of spindle,	⅞
Length of *body* of spindle,	9⅜
Diameter of *lower* part of spindle,	1 1/16
Clearance at *top* of spindle,	½
Lift of valve,	½
Length of *guide* of hood,	1½
Breadth of cotter,	1 1/16
Thickness of cotter,	7/32
Length of *thread* of compressing screw,	1⅜
Diameter of compressing screw,	1½
Depth of *thread* (or part screwed) in *top* cover for compressing screw,	1⅛
Diameter of bolts for *bottom* flange of chest,	⅝
Number of bolts for *bottom* flange of chest,	nine
Diameter of bolts and studs for spring case at *top*,	½
Diameter of bolts and studs for spring case at *bottom*,	⅝
Number of bolts or studs in each flange of spring case,	four
Diameter of drain pipe,	¾
Length of lifting lever,	2
Diameter of easing gear shaft,	⅞

The bolts, studs, easing gear shaft, and lifting lever should be of wrought iron.

FURNACES WITH FLANGED JOINTS.

Iron and Steel Plates.

When *horizontal* furnaces of *ordinary* diameter are constructed of rings welded longitudinally, the rings flanged at the ends, made up of more than one ring riveted together, so as to form one complete furnace, and the iron or mild steel plates of which they are made are of the *highest* quality, a prudent working pressure, &c., may be determined by the following formulæ, *provided* the length between the centres of the rings does *not* exceed that stated in the column "maximum lengths for thickness in inches" in Tables Nos. 78 and 284 Iron Plates, and Nos. 175 and 342 Steel Plates, and attention is also paid to the notes which follow the formulæ :

D = Diameter of furnace, in inches, outside.†
l = Length or distance between centre of flanges, in inches.†
T = Thickness of plate, in inches.
B = Working pressure in lbs., per square inch.†
C = 9000 for Iron plates.
C = 9900 for Steel plates.

$$\frac{C \times T}{3 \times D}\left(5 - \frac{l + 12}{60 \times T}\right) = B.$$

$$\frac{C \times T}{3 \times B}\left(5 - \frac{l + 12}{60 \times T}\right) = D.$$

$$\frac{1}{5}\left(\frac{3 \times B \times D}{C} + \frac{l + 12}{60}\right) = T.$$

$$60\left(5 \times T - \frac{3 \times B \times D}{C}\right) - 12 = l.$$

† If the *pressure* and *diameter* remain the *same*, then for every thirty-second part of an inch the plate is increased in thickness, the *length* between the centres of the flanges may be increased about 9⅜ inches.‡

The radii of the flanges on the fire side should be about 1·5 inch. The depth of the flanges from the fire side should be three times the diameter of the rivet, plus 1·5 inch. The thickness of the flanges should be kept as near the thickness of the plate as practicable. The distance from the side of the rivet holes to the edge of the flange should not be less than the diameter of the rivet. The diameter of the rivets should be at least ⅜ inch more than the thickness of the plate. The depth of the rings between the flange should not be less than three times the diameter of the rivet. The thickness of the ring may be about one-half the thickness of the plate, and to make a first class job should be turned. The holes in the flanges and rings should be drilled, if not drilled in place they should be rimered out after drilling when in place ; the holes should be a little taper and the heads of the rivets of moderate size. After all welding, flanging, and heating, the flanged rings should be efficiently annealed. If there be any signs of defects in the flanges or welding, &c., the length should not be used.

‡ Should not exceed (120 T − 12).

RIVETED JOINTS (Iron and Steel).

MULTIPLIERS for finding the *vertical* distance between Rows of Rivets and also the thickness of Butt Straps.

The Tables which immediately follow, Nos. 345 to 347, will be found of service when designing riveted joints, either made of iron or mild steel plates, when the proportions of pitch and diameter of rivets differ from those in the joints given in the tables RIVETED JOINTS, *provided all the rivets are of the same diameter.*

When the pitch and diameter of rivets have been determined the Multipliers in the tables immediately following may be used to ascertain the *least vertical* distance between the rows of rivets; the tables may also be used to find the *least* thickness butt straps should be, when each alternate rivet is omitted in the *outer* rows and *not* the inner.

The tables have been constructed for several descriptions of riveting viz.:—

Ordinary ZIG-ZAG *Riveting*, double, treble, and quadruple.

ZIG-ZAG *Riveting when* each alternate rivet has been omitted in the *outer* rows.

CHAIN *Riveting when* each alternate rivet has been omitted in the *outer* rows.

When the pitch and diameter of rivets have been determined, the percentage of the joint $\left(\frac{p-d}{p}\right)$ 100 may be found in the usual way, p being the pitch and d the diameter of the rivets, then in one of the tables, but it must be the table applicable to the description of riveting, a number will be found, opposite the percentage, by which the pitch p should be multiplied, and the product so obtained is the *least vertical* distance that should be between the rows of rivets.

When there are three rows of rivets and each alternate rivet omitted in the *outer* row, a Multiplier will also be found in one of the tables immediately following, but it must be the table applicable to the description of the joint, and by its use the *least vertical* distance between the *inner* rows of rivets can be determined.

In the case of butt joints, where the pitch of the rivets in the row *next* the butt is only *half* that of the rivets in the *outer* row, opposite the *given* percentages in the table applicable will also be the number by which the thickness of the plate should be multiplied, in order to determine the *least* thickness that butt straps should be.

IRON AND STEEL BOILERS.

The *least* thickness of butt straps when the rivets in *each* row are of the *same* pitch is of course five-eighths the thickness of the plates.

The following examples show the application of the tables, and will facilitate their use :—

(1) If it be desired to construct an *Ordinary* ZIG-ZAG Double Riveted Double Butt Joint of plate ¾ inch thick, rivets 1 inch diameter and the pitch 4 inches :

Then the percentage of the joint $\left(\frac{4-1}{4}\right)100$ is found to be 75.

In the Table applicable (No. 345) and opposite the percentage 75 in column M the number is found to be ·4899 by which the pitch 4 inches should be multiplied, then $\cdot4899 \times 4 = 1\cdot9596$ inches, which is the *least vertical* distance that there should be between the rows. In this case, as the plates are ¾ inch thick, the *least* thickness of *each* butt strap is $\frac{3}{4} \times \frac{5}{8} = \frac{15}{32}$ inch.

(2) If it be desired to construct a Treble Riveted ZIG-ZAG Double Butt Joint, but with each alternate rivet omitted in the *outer* rows, such as is illustrated on p. 318, Table No. 160 :

Then if the plate be $1\frac{1}{16}$ inch thick, the diameter of rivets $1\frac{1}{16}$ inch, and the pitch 7 inches, then $\left(\frac{7-1\frac{1}{16}}{7}\right)100 = 84\cdot82$, which is the percentage, and *opposite* 84·75 (the nearest number to 84·82) in the table applicable (No. 346) is found in column A ·3772, which multiplied by 7, the pitch equals 2·6404 inches, the *least vertical* distance that there should be between the *outer* rows of rivets, and in column B, opposite the same percentage, will be found ·2604, which multiplied by 7, the pitch equals 1·8228 inches, the *least vertical* distance that there should be between the *inner* rows.

As the pitch in the *inner* row in the case dealt with in the preceding paragraph was only *half* that of the *outer* rows, the thickness of plate should be multiplied by the number in column C to obtain the least thickness that the butt straps should be, then $1\cdot0625 \times \cdot7621 = \cdot8097$, or say $\frac{13}{16}$ inch, which is the *least* thickness *each* butt strap should be.

(3) If it be desired to construct a Treble Riveted (Chain Riveting) Double Butt Joint, with each alternate rivet omitted in the *outer* rows such as in the previous case, as illustrated on p. 318, Table No. 160, when the thickness of plate is to be 1¼ inch, the diameter

of the rivets $1\frac{1}{4}$ inch, and the pitch of rivets in the *outer* rows $8\frac{1}{4}$ inches :—

Then $\left(\frac{8\frac{1}{4}-1\frac{1}{4}}{8\frac{1}{4}}\right)100=84\cdot84$, which is the percentage of the joint, and opposite 84·75 (the nearest number to 84·84) in the table applicable (No. 347) will be found in column A ·4323, which multiplied by $8\frac{1}{4}$ inches, the pitch equals 3·566 inches, which is the *least vertical* distance there should be between the *outer* rows of rivets. The *least* distance between the *inner* rows, in this case, it being Chain Riveting, is equal to

$$\frac{4d+1}{2}=\frac{4\times1\frac{1}{4}+1}{2}=3 \text{ inches.}$$

If however, the joint last referred to had been ZIG-ZAG Riveted in the *inner* rows, then, in order to determine the *least* distance that there should be between them (inner rows), the *outside* pitch should be multiplied by the number in column Z in the *same Table*, or $8\cdot25\times\cdot2604=2\cdot148$ inches, which is the *least* distance there should be between the rows.

In this case also, as the pitch of rivets in the *inner* rows is only half that of the *outer* rows, the thickness of plate should be multiplied by the number in column C, the product is the *least* thickness that *each* butt strap should be, thus, $1\cdot25\times\cdot7621=\cdot9526$, or say $\frac{31}{32}$ inch is the *least* thickness *each* butt strap should be.

As has been alluded to in another part of the book, as to the minimum thickness of butt straps, it may be desirable in some cases to make them thicker, more particularly in the case of wide pitches, so as to insure tight joints, but the thickness obtained by the use of the following tables is sufficient as far as strength is concerned.

RIVETED JOINTS (IRON AND STEEL).

Ordinary ZIG-ZAG riveting (Lap or Butt).

MULTIPLIERS for finding the *vertical* distance between rows of rivets, the pitch and percentage of joint having already been determined on.

The *vertical* distance between rows of rivets is found by multiplying the pitch by the number opposite the given percentage as found by the formula $\left(\frac{p-d}{p}\right)100$, p being the pitch and d the diameter of rivets.

Percentage of Joint.	Multipliers for Vertical Distance between Rows of Rivets.	Percentage of Joint.	Multipliers for Vertical Distance between Rows of Rivets.	Percentage of Joint.	Multipliers for Vertical Distance between Rows of Rivets.	Percentage of Joint.	Multipliers for Vertical Distance between Rows of Rivets.
%	M	%	M	%	M	%	M
60·0	·5724	66·25	·5387	72·50	·5041	78·75	·4682
60·25	·5710	66·50	·5374	72·75	·5027	79·0	·4668
60·50	·5697	66·75	·5360	73·0	·5013	79·25	·4653
60·75	·5684	67·0	·5346	73·25	·4998	79·50	·4638
61·0	·5670	67·25	·5333	73·50	·4984	79·75	·4623
61·25	·5657	67·50	·5319	73·75	·4970	80·0	·4609
61·50	·5644	67·75	·5305	74·0	·4956	80·25	·4594
61·75	·5630	68·0	·5291	74·25	·4942	80·50	·4579
62·0	·5617	68·25	·5278	74·50	·4928	80·75	·4564
62·25	·5604	68·50	·5264	74·75	·4913	81·0	·4549
62·50	·5590	68·75	·5250	75·0	·4899	81·25	·4535
62·75	·5577	69·0	·5236	75·25	·4885	81·50	·4520
63·0	·5563	69·25	·5222	75·50	·4870	81·75	·4505
63·25	·5550	69·50	·5208	75·75	·4856	82·0	·4490
63·50	·5536	69·75	·5195	76·0	·4842	82·25	·4475
63·75	·5523	70·0	·5181	76·25	·4827	82·50	·4460
64·0	·5509	70·25	·5167	76·50	·4813	82·75	·4445
64·25	·5496	70·50	·5153	76·75	·4798	83·0	·4430
64·50	·5482	70·75	·5139	77·0	·4784	83·25	·4415
64·75	·5469	71·0	·5125	77·25	·4769	83·50	·4399
65·0	·5455	71·25	·5111	77·50	·4755	83·75	·4384
65·25	·5442	71·50	·5097	77·75	·4740	84·0	·4369
65·50	·5428	71·75	·5083	78·0	·4726	84·25	·4354
65·75	·5415	72·0	·5069	78·25	·4711	84·50	·4339
66·0	·5401	72·25	·5055	78·50	·4697	84·75	·4323

Vertical distance between rows = $p \times M$.

M being the MULTIPLIER opposite the given percentage.

The *minimum* thickness of *each* butt strap is ⅝ the thickness of the shell plate.

ZIG-ZAG riveting when each alternate rivet is omitted in the *outer* rows (Lap or Butt).

MULTIPLIERS for finding the *vertical* distance between rows of rivets, the *outer* pitch and percentage having already been determined on.

The *vertical* distance between outer *or* inner row of rivets is found by multiplying the outer pitch by the respective numbers opposite the given percentage as found by the formula $\left(\frac{p-d}{p}\right)100$, p being the pitch and d the diameter of rivets.

Percentage of Joint.	Multipliers for Vertical Distance between *outer* Rows of Rivets.*	Multipliers for Vertical Distance between *inner* Rows.	Multipliers for Thickness of Butt Strap.	Percentage of Joint.	Multipliers for Vertical Distance between *outer* Rows of Rivets.*	Multipliers for Vertical Distance between *inner* Rows.	Multipliers for Thickness of Butt Strap.
%	A	B	C	%	A	B	C
75·0	·4899	·3122	·9375	80·75	·4243	·2822	·8206
75·25	·4871	·3110	·9313	81·0	·4214	·2808	·8165
75·50	·4843	·3097	·9252	81·25	·4185	·2795	·8125
75·75	·4815	·3084	·9193	81·50	·4156	·2782	·8085
76·0	·4786	·3071	·9135	81·75	·4127	·2768	·8046
76·25	·4758	·3058	·9077	82·0	·4098	·2755	·8008
76·50	·4730	·3045	·9021	82·25	·4068	·2741	·7970
76·75	·4702	·3032	·8966	82·50	·4039	·2728	·7933
77·0	·4673	·3019	·8912	82·75	·4009	·2714	·7896
77·25	·4645	·3006	·8859	83·0	·3980	·2700	·7860
77·50	·4617	·2993	·8807	83·25	·3950	·2687	·7824
77·75	·4588	·2980	·8756	83·50	·3921	·2673	·7789
78·0	·4560	·2967	·8705	83·75	·3891	·2659	·7755
78·25	·4531	·2954	·8656	84·0	·3861	·2646	·7721
78·50	·4502	·2941	·8607	84·25	·3832	·2632	·7687
78·75	·4474	·2928	·8560	84·50	·3802	·2618	·7654
79·0	·4445	·2915	·8513	84·75	·3772	·2604	·7621
79·25	·4417	·2902	·8467	85·0	·3742	·2590	·7589
79·50	·4388	·2888	·8422	85·25	·3712	·2576	·7558
79·75	·4359	·2875	·8377	85·50	·3681	·2562	·7526
80·0	·4330	·2862	·8333	85·75	·3651	·2549	·7496
80·25	·4301	·2849	·8290	86·0	·3621	·2534	·7465
80·50	·4272	·2835	·8248	86·25	·3590	·2520	·7435

Vertical distance between *outer* rows = $p \times$ A.
Vertical distance between *inner* rows = $p \times$ B.
Thickness of Butt Straps = T × C.
T = Thickness of shell plates in inches.

* By outer row is meant the row next the edge of butt strap or, in lap joints, the row next the edge of plate.

Chain Riveting when each alternate rivet is omitted in the *outer* rows. (Lap or Butt.)

MULTIPLIERS for finding the *vertical* distance between outer rows of rivets, the *outer* pitch and percentage having been already determined on.

The *vertical* distance between *outer* rows of rivets is found by multiplying the *outer* pitch by the number opposite the given percentages as found by the formula $\left(\frac{p-d}{d}\right)$ 100, p being the pitch and d the diameter of the rivets.

Percentage of Joint.	Multipliers for *Vertical* Distance between outer Rows of Rivets.*	Multipliers for *Vertical* Distance between inner Rows.†	Multipliers for Thickness of Butt Strap.	Percentage of Joint.	Multipliers for *Vertical* Distance between outer Rows of Rivets.*	Multipliers for *Vertical* Distance between inner Rows.†	Multipliers for Thickness of Butt Strap.
%	A	Z†	C	%	A	Z†	C
75·0	·4899	·3122	·9375	80·75	·4564	·2822	·8206
75·25	·4885	·3110	·9313	81·0	·4549	·2808	·8165
75·50	·4870	·3097	·9252	81·25	·4535	·2795	·8125
75·75	·4856	·3084	·9193	81·50	·4520	·2782	·8085
76·0	·4842	·3071	·9135	81·75	·4505	·2768	·8046
76·25	·4827	·3058	·9077	82·0	·4490	·2755	·8008
76·50	·4813	·3045	·9021	82·25	·4475	·2741	·7970
76·75	·4798	·3032	·8966	82·50	·4460	·2728	·7933
77·0	·4784	·3019	·8912	82·75	·4445	·2714	·7896
77·25	·4769	·3006	·8859	83·0	·4430	·2700	·7860
77·50	·4755	·2993	·8807	83·25	·4415	·2687	·7824
77·75	·4740	·2980	·8756	83·50	·4399	·2673	·7789
78·0	·4726	·2967	·8705	83·75	·4384	·2659	·7755
78·25	·4711	·2954	·8656	84·0	·4369	·2646	·7721
78 50	·4697	2941	·8607	84·25	·4354	·2632	·7687
78 75	·4682	2928	·8560	84·50	·4339	·2618	·7654
79·0	·4668	·2915	·8513	84·75	·4323	·2604	·7621
79·25	·4653	·2902	·8467	85·0	·4308	·2590	·7589
79·50	·4638	·2888	·8422	85·25	·4293	·2576	·7558
79·75	·4623	·2875	·8377	85·50	·4277	·2562	·7526
80·0	·4609	·2862	·8333	85·75	·4262	·2549	·7496
80·25	·4594	·2849	·8290	86·0	·4247	·2534	·7465
80·50	·4579	·2835	·8248	86·25	·4242	·2520	·7435

Vertical distance between *outer* rows $= p \times A$, but should *never* be *less* than $\frac{4d+1}{2}$.

When there are three rows of rivets the *vertical* distance between *inner* rows should be $\frac{4d+1}{2}$.

Thickness of Butt straps $= T \times C$. T = Thickness of shell plate, in inches.

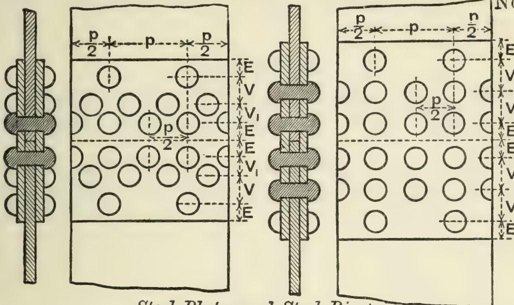
* By *outer* row is meant the row next the edge of butt strap or, in lap joints, the row next the edge of the plate.

† Column Z is given to meet cases when the *inner* rows are *zig-zag* riveted, then the *vertical* distance between *inner* rows $= p \times Z$.

TABLE No. 348.

Treble Riveted Double Butt Joints, each alternate Rivet omitted in the outer row.

Zig Zag Riveting. Chain Riveting.



Steel Plates and Steel Rivets.

28 tons. D×B×F.	Thickness of Plates.	Diameter of Rivets.	Pitch of Rivets.	Centre of Rivets to Edge of Plates.	Distance between Rows of Rivets. Zig Zag Riveting.		Chain Riveting.		Thickness of Butt Straps.	Percentage of Joint.
N	T	d	p	E	V	V_1	V	V_1	T_1	
67518	5/8	11/16	4·956	1·031	1·786	1·252	2·100	1·875	·465	86·12
70852	21/32	23/32	5·162	1·078	1·864	1·306	2·189	1·937	·489	86·07
74183	11/16	3/4	5·368	1·125	1·941	1·359	2·278	2·000	·513	86·02
77519	23/32	25/32	5·574	1·171	2·019	1·413	2·367	2·062	·536	85·98
80852	3/4	13/16	5·781	1·218	2·097	1·466	2·456	2·125	·560	85·94
84182	25/32	27/32	5·987	1·265	2·174	1·520	2·545	2·187	·584	85·90
87518	13/16	7/8	6·194	1·312	2·252	1·574	2·635	2·250	·607	85·87
90853	27/32	29/32	6·401	1·359	2·329	1·627	2·724	2·312	·631	85·84
94185	7/8	15/16	6·607	1·406	2·407	1·681	2·813	2·375	·655	85·81
97514	29/32	31/32	6·814	1·453	2·485	1·735	2·902	2·437	·678	85·78
100842	15/16	1	7·021	1·500	2·562	1·789	2·992	2·500	·702	85·75
104179	31/32	1 1/32	7·228	1·546	2·640	1·842	3·081	2·562	·726	85·73
107502	1	1 1/16	7·435	1·593	2·718	1·896	3·170	2·625	·750	85·70
110835	1 1/32	1 3/32	7·642	1·640	2·795	1·950	3·259	2·687	·773	85·68
114167	1 1/16	1 1/8	7·849	1·687	2·873	2·003	3·349	2·750	·797	85·66
117498	1 3/32	1 5/32	8·056	1·734	2·951	2·057	3·438	2·812	·821	85·64
120826	1 1/8	1 3/16	8·263	1·781	3·029	2·111	3·527	2·875	·844	85·62
124168	1 5/32	1 7/32	8·470	1·828	3·106	2·165	3·617	2·937	·868	85·61
127494	1 3/16	1 1/4	8·677	1·875	3·184	2·218	3·706	3·000	·892	85·59
130819	1 7/32	1 9/32	8·884	1·921	3·262	2·272	3·795	3·062	·916	85·57
134158	1 1/4	1 5/16	9·092	1·968	3·340	2·326	3·885	3·125	·939	85·56
137495	1 9/32	1 11/32	9·299	2·015	3·417	2·380	3·974	3·187	·963	85·55
140800	1 5/16	1 3/8	9·500	2·062	3·494	2·432	4·062	3·250	·987	85·52

N = Numeral appropriate to the thickness of plate and tensile strength of steel. B = Working pressure, in pounds, per square inch. D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety. See Notes page 294 and following.

$$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F.$$

NUMERALS.

For Riveted Joints in Steel Plates having a Tensile Strength of 26, 27, 28, 29, 30, 31 and 32 tons per square inch.

These numerals are applicable to the thickness of plate which they are opposite, provided the calculated percentage of the joint is as given opposite the same thickness in the Table immediately preceding.

Thickness of Plate.	26 tons. D×B×F.	27 tons. D×B×F.	28 tons. D×B×F.	29 tons. D×B×F.	30 tons. D×B×F.	31 tons. D×B×F.	32 tons. D×B×F.
T	N	N	N	N	N	N	N
5/8	62695	65106	67518	69929	72340	74752	77163
21/32	65791	68322	70852	73383	75913	78444	80974
11/16	68884	71534	74183	76833	79482	82131	84781
23/32	71982	74751	77519	80288	83056	85825	88593
3/4	75077	77964	80852	83739	86627	89515	92402
25/32	78169	81175	84182	87188	90195	93201	96208
13/16	81267	84393	87518	90644	93770	96895	100021
27/32	84363	87608	90853	94097	97342	100587	103832
7/8	87457	90821	94185	97548	100912	104276	107640
29/32	90549	94032	97514	100997	104480	107962	111445
15/16	93639	97240	100842	104443	108045	111646	115248
31/32	96737	100458	104179	107899	111620	115341	119061
1	99823	103662	107502	111341	115180	119020	122859
1 1/32	102918	106877	110835	114794	118752	122710	126669
1 1/16	106012	110090	114167	118245	122322	126399	130477
1 3/32	109105	113301	117498	121694	125890	130087	134283
1 1/8	112196	116511	120826	125142	129457	133772	138087
1 5/32	115299	119734	124168	128603	133037	137472	141907
1 3/16	118388	122941	127494	132048	136601	141155	145708
1 7/32	121475	126147	130819	135491	140163	144835	149507
1 1/4	124575	129366	134158	138949	143740	148532	153323
1 9/32	127674	132585	137495	142406	147317	152227	157138
1 5/16	130742	135771	140800	145828	150857	155885	160914

N = Numeral appropriate to the thickness of plate and tensile strength of steel. B = Working pressure, in pounds, per square inch. D = Diameter of boiler, inside, in inches. F = *Nominal* factor of safety. See Notes page 294 and following.

$D \times B \times F = N \qquad \frac{N}{B \times F} = D \qquad \frac{N}{D \times F} = B \qquad \frac{N}{D \times B} = F.$

WHITWORTH SCREWS.

Col. 1. Diam. of Screw.	Col. 2. Number of Threads per inch.	Col. 3. Depth of Thread.	Col. 4. Diam. at Bottom of Thread.	Col. 5. Area at Bottom of Thread.	Col. 1. Diam. of Screw.	Col. 2. Number of Threads per inch.	Col. 3. Depth of Thread.	Col. 4. Diam. at Bottom of Thread.	Col. 5. Area at Bottom of Thread.
inches.		inch.	inch.	sq. ins.	inches.		inch.	inch.	sq. ins.
⅛	40	·0160	·093	·0067	2⅛	4½	·1422	1·840	2·659
5/32	32	·0200	·116	·0105	2¼	4	·1600	1·930	2·925
3/16	24	·0266	·134	·0141	2⅜	4	·1600	2·055	3·316
¼	20	·0320	·186	·0271	2½	4	·1600	2·180	3·732
5/16	18	·0355	·241	·0456	2⅝	4	·1600	2·305	4·172
⅜	16	·0400	·295	·0683	2¾	3½	·1828	2·384	4·463
7/16	14	·0457	·346	·0940	2⅞	3½	·1828	2·509	4·944
½	12	·0533	·393	·1213	3	3½	·1828	2·634	5·449
⅝	11	·0581	·508	·2026	3¼	3¼	·1969	2·856	6·406
¾	10	·0640	·622	·3038	3½	3¼	·1969	3·106	7·576
⅞	9	·0711	·732	·4208	3¾	3	·2133	3·323	8·762
1	8	·0800	·840	·5541	4	3	·2133	3·573	10·026
1 ⅛	7	·0914	·942	·6969	4¼	2⅞	·2226	3·804	11·365
1 ¼	7	·0914	1·067	·8941	4½	2⅞	·2226	4·054	12·907
1 ⅜	6	·1066	1·161	1·058	4¾	2¾	·2327	4·284	14·414
1 ½	6	·1066	1·286	1·298	5	2¾	·2327	4·534	16·145
1 ⅝	5	·1280	1·369	1·471	5¼	2⅝	·2438	4·762	17·810
1 ¾	5	·1280	1·494	1·753	5½	2⅝	·2438	5·012	19·729
1 ⅞	4½	·1422	1·590	1·985	5¾	2½	·2560	5·238	21·549
2	4½	·1422	1·715	2·310	6	2½	·2560	5·488	23·654

The threads of screws should be made to an angle of 55 degrees, and one-sixth the depth of the V should be rounded off at the top and at the bottom, although the ratio of pitch to diameter may in some screws differ from the ratios in the above Table if the V threads be made to an angle of 55 degrees (as the V threads of all screws should be), and if one-sixth be rounded off at the top and at the bottom the net diameter at the bottom of the thread will be found by subtracting twice the number in Column 3, opposite its given number of threads per inch from the outside diameter, or diameter over all, of the screw.

Iron Plates from $\frac{1}{4}$ inch to $1\frac{1}{4}$ inch thick.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
inches.	N	N	N	N	N
1/4	52·22	51·08	50·0	48·95	47·96
9/32	58·75	57·47	56·25	55·07	53·95
5/16	65·27	63·85	62·50	61·19	59·94
11/32	71·80	70·24	68·75	67·31	65·94
3/8	78·33	76·63	75·0	73·43	71·93
13/32	84·86	83·01	81·25	79·55	77·93
7/16	91·38	89·40	87·50	85·67	83·92
15/32	97·91	95·78	93·75	91·79	89·92
1/2	104·44	102·17	100·0	97·91	95·91
17/32	110·97	108·56	106·25	104·03	101·91
9/16	117·50	114·94	112·50	110·15	107·90
19/32	124·02	121·33	118·75	116·27	113·90
5/8	130·55	127·71	125·0	122·39	119·89
21/32	137·08	134·10	131·25	128·50	125·89
11/16	143·61	140·49	137·50	134·62	131·88
23/32	150·13	146·87	143·75	140·74	137·88
3/4	156·66	153·26	150·0	146·86	143·87
25/32	163·19	159·64	156·25	152·98	149·87
13/16	169·72	166·03	162·50	159·10	155·86
27/32	176·25	172·41	168·75	165·22	161·86
7/8	182·77	178·80	175·0	171·34	167·85
29/32	189·30	185·19	181·25	177·46	173·85
15/16	195·83	191·57	187·50	183·58	179·84
31/32	202·36	197·96	193·75	189·70	185·84
1	208·88	204·34	200·0	195·82	191·83
1 1/32	215·41	210·73	206·25	201·94	197·83
1 1/16	221·94	217·12	212·50	208·06	203·82
1 3/32	228·47	223·50	218·75	214·18	209·82
1 1/8	235·0	229·89	225·0	220·30	215·81
1 5/32	241·52	236·27	231·25	226·42	221·81
1 3/16	248·05	242·66	237·50	232·54	227·80
1 7/32	254·58	249·04	243·75	238·65	233·80
1 1/4	261·11	255·43	250·0	244·77	239·79

$$\frac{N \times \%}{D} = B. \quad \frac{N \times \%}{B} = D. \quad \frac{D \times B}{N} = \%. \quad \frac{D \times B}{\%} = N.$$

N = Numeral. % = Calculated percentage strength of joint.
D = Inside diameter in inches.
B = Working pressure per square inch in pounds.

CYLINDRICAL BOILER SHELLS.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 26 tons per square inch.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
inches.	N	N	N	N	N
1/4	64·71	63·30	61·95	60·66	59·42
9/32	72·80	71·21	69·70	68·25	66·85
5/16	80·88	79·13	77·44	75·83	74·28
11/32	88·97	87·04	85·19	83·41	81·71
3/8	97·06	94·95	92·93	91·0	89·14
13/32	105·15	102·86	100·68	98·58	96·57
7/16	113·24	110·78	108·42	106·16	104·0
15/32	121·33	118·69	116·17	113·75	111·42
1/2	129·42	126·60	123·91	121·33	118·85
17/32	137·51	134·52	131·66	128·91	126·28
9/16	145·60	142·43	139·40	136·50	133·71
19/32	153·68	150·34	147·14	144·08	141·14
5/8	161·77	158·26	154·89	151·66	148·57
21/32	169·86	166·17	162·63	159·25	156·0
11/16	177·95	174·08	170·38	166·83	163·42
23/32	186·04	182·0	178·12	174·41	170·85
3/4	194·13	189·91	185·87	182·0	178·28
25/32	202·22	197·82	193·61	189·58	185·71
13/16	210·31	205·74	201·36	197·16	193·14
27/32	218·40	213·65	209·10	204·75	200·57
7/8	226·48	221·56	216·85	212·33	208·0
29/32	234·57	229·47	224·59	219·91	215·42
15/16	242·66	237·39	232·34	227·50	222·85
31/32	250·75	245·30	240·08	235·08	230·28
1	258·84	253·21	247·83	242·66	237·71
1 1/32	266·93	261·13	255·57	250·25	245·14
1 1/16	275·02	269·04	263·32	257·83	252·57
1 3/32	283·11	276·95	271·06	265·41	260·0
1 1/8	291·20	284·87	278·80	273·0	267·42
1 5/32	299·28	292·78	286·55	280·58	274·85
1 3/16	307·37	300·69	294·29	288·16	282·28
1 7/32	315·46	308·60	302·04	295·75	289·71
1 1/4	323·55	316·52	309·78	303·33	297·14
1 9/32	331·64	324·43	317·53	310·91	304·57
1 5/16	339·73	332·34	325·27	318·50	312·0
1 11/32	347·82	340·26	333·02	326·08	319·42
1 3/8	355·91	348·17	340·76	333·66	326·85

N = Numeral. % = Calculated percentage strength of joint B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 27 tons per square inch.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
inches.	N	N	N	N	N
1/4	67·2	65·74	64·34	63·0	61·71
9/32	75·6	73·95	72·38	70·87	69·42
5/16	84·0	82·17	80·42	78·75	77·14
11/32	92·4	90·39	88·46	86·62	84·85
3/8	100·8	98·60	96·51	94·50	92·57
13/32	109·2	106·82	104·55	102·37	100·28
7/16	117·6	115·04	112·59	110·25	108·0
15/32	126·0	123·26	120·63	118·12	115·71
1/2	134·4	131·47	128·68	126·0	123·42
17/32	142·8	139·69	136·72	133·87	131·14
9/16	151·2	147·91	144·76	141·75	138·85
19/32	159·6	156·13	152·80	149·62	146·57
5/8	168·0	164·34	160·85	157·50	154·28
21/32	176·4	172·56	168·89	165·37	162·0
11/16	184·8	180·78	176·93	173·25	169·71
23/32	193·2	189·0	184·97	181·12	177·42
3/4	201·6	197·21	193·02	189·0	185·14
25/32	210·0	205·43	201·06	196·87	192·85
13/16	218·4	213·65	209·10	204·75	200·57
27/32	226·8	221·87	217·14	212·62	208·28
7/8	235·2	230·08	225·19	220·50	216·0
29/32	243·6	238·30	233·23	228·37	223·71
15/16	252·0	246·52	241·27	236·25	231·42
31/32	260·4	254·74	249·32	244·12	239·14
1	268·8	262·95	257·36	252·0	246·85
1 1/32	277·2	271·17	265·40	259·87	254·57
1 1/16	285·6	279·39	273·44	267·75	262·28
1 3/32	294·0	287·60	281·50	275·62	270·0
1 1/8	302·4	295·82	289·53	283·50	277·71
1 5/32	310·8	304·04	297·57	291·37	285·42
1 3/16	319·2	312·26	305·61	299·25	293·14
1 7/32	327·6	320·47	313·66	307·12	300·85
1 1/4	336·0	328·69	321·70	315·0	308·57
1 9/32	344·4	336·91	329·74	322·87	316·28
1 5/16	352·8	345·13	337·78	330·75	324·0
1 11/32	361·2	353·34	345·83	338·62	331·71
1 3/8	369·6	361·56	353·87	346·50	339·42

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Tensile Strength of Plates 26 tons per square inch. TABLE No. 354.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
ins.	N	N	N	N	N
$1\frac{13}{32}$	364·0	356·08	348·51	341·25	334·28
$1\frac{7}{16}$	372·08	364·0	356·25	348·83	341 71
$1\frac{15}{32}$	380·17	371·91	364·0	356·41	349·14
$1\frac{1}{2}$	388·26	379·82	371·74	364·0	356·57
$1\frac{17}{32}$	396·35	387·74	379·49	371·58	364·0
$1\frac{9}{16}$	404·44	395·65	387·23	379·16	371·42
$1\frac{19}{32}$	412·53	403·56	394·97	386·75	378·85
$1\frac{5}{8}$	420·62	411·47	402·72	394·33	386·28

CYLINDRICAL BOILER SHELLS.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Tensile Strength of Plates 27 tons per square inch. TABLE No. 355.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
ins.	N	N	N	N	N
$1\frac{13}{32}$	378·0	369·78	361·91	354·37	347·14
$1\frac{7}{16}$	386·4	378·0	369·95	362·25	354·85
$1\frac{15}{32}$	394·8	386·21	378·0	370·12	362 57
$1\frac{1}{2}$	403·2	394·43	386·04	378·0	370·28
$1\frac{17}{32}$	411·6	402·65	394·08	385·87	378·0
$1\frac{9}{16}$	420·0	410·87	402·12	393·75	385·71
$1\frac{19}{32}$	428·4	419·08	410·17	401·62	393·42
$1\frac{5}{8}$	436·8	427·30	418·21	409·50	401·14

N = Numeral. % = Calculated percentage strength of joint.
B = Working pressure per square inch in pounds.
D = Inside diameter in inches

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 356.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 28 tons per square inch.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
Inches.	N	N	N	N	N
1/4	69·68	68·17	66·72	65·33	64·0
9/32	78·40	76·79	75·06	73·50	72·0
5/16	87·11	85·21	83·40	81·66	80·0
11/32	95·82	93·74	91·74	89·83	88·0
3/8	104·53	102·26	100·08	98·0	96·0
13/32	113·24	110·78	108·42	106·16	104·0
7/16	121·95	119·30	116·76	114·33	112·0
15/32	130·66	127·82	125·10	122·50	120·0
1/2	139·37	136·34	133·44	130·66	128·0
17/32	148·08	144·87	141·78	138·83	136·0
9/16	156·80	153·39	150·12	147·0	144·0
19/32	165·51	161·91	158·46	155·16	152·0
5/8	174·22	170·43	166·80	163·33	160·0
21/32	182·93	178·95	175·14	171·50	168·0
11/16	191·64	187·47	183·49	179·66	176·0
23/32	200·35	196·0	191·83	187·83	184·0
3/4	209·06	204·52	200·17	196·0	192·0
25/32	217·77	213·04	208·51	204·16	200·0
13/16	226·48	221·56	216·85	212·33	208·0
27/32	235·20	230·08	225·19	220·50	216·0
7/8	243·91	238·60	233·53	228·66	224·0
29/32	252·62	247·13	241·87	236·83	232·0
15/16	261·33	255·65	250·21	245·0	240·0
31/32	270·04	264·17	258·55	253·16	248·0
1	278·75	272·69	266·89	261·33	256·0
1 1/32	287·46	281·21	275·23	269·50	264·0
1 1/16	296·17	289·74	283·57	277·66	272·0
1 3/32	304·88	298·26	291·91	285·83	280·0
1 1/8	313·60	306·78	300·25	294·0	288·0
1 5/32	322·31	315·30	308·59	302·16	296·0
1 3/16	331·02	323·82	316·93	310·33	304·0
1 7/32	339·73	332·34	325·27	318·50	312·0
1 1/4	348·44	340·87	333·61	326·66	320·0
1 9/32	357·15	349·39	341·95	334·83	328·0
1 5/16	365·86	357·91	350·29	343·0	336·0
1 11/32	374·57	366·43	358·63	351·16	344·0
1 3/8	383·28	374·95	366·97	359·33	352·0

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $1\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 29 tons per square inch.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
inches.	N	N	N	N	N
1/4	72·17	70·60	69·10	67·66	66·28
9/32	81.20	79·43	77·74	76·12	74·57
5/16	90·22	88·26	86·38	84·58	82·85
11/32	99·24	97·08	95·02	93·04	91·14
3/8	108·26	105·91	103·66	101·50	99·42
13/32	117·28	114·74	112·29	109·95	107·71
7/16	126·31	123·56	120·93	118·41	116·0
15/32	135·33	132·39	129·57	126·87	124·28
1/2	144·35	141·21	138·21	135·33	132·57
17/32	153·37	150·04	146·85	143·79	140·85
9/16	162·40	158·87	155·49	152·25	149·14
19/32	171·42	167·69	164·12	160·70	157·42
5/8	180·44	176·52	172·76	169·16	165·71
21/32	189·46	185·34	181·40	177·62	174·0
11/16	198·48	194·17	190·04	186·08	182·28
23/32	207·51	203·0	198·68	194·54	190·57
3/4	216·53	211·82	207·32	203·0	198·85
25/32	225·55	220·65	215·95	211·45	207·14
13/16	234·57	229·47	224·59	219·91	215·42
27/32	243·60	238·30	233·23	228·37	223·71
7/8	252·62	247·13	241·87	236·83	232·0
29/32	261·64	255·95	250·51	245·29	240·28
15/16	270·66	264·78	259·14	253·75	248·57
31/32	279·68	273·60	267·78	262·20	256·85
1	288·71	282·43	276·42	270·66	265·14
1 1/32	297·73	291·26	285·06	279·12	273·42
1 1/16	306·75	300·08	293·70	287·58	281·71
1 3/32	315·77	308·91	302·34	296·04	290·0
1 1/8	324·80	317·74	310·97	304·50	298·28
1 5/32	333·82	326·56	319·61	312·95	306·57
1 3/16	342·84	335·39	328·25	321·41	314·85
1 7/32	351·86	344.21	336·89	329·87	323·14
1 1/4	360·88	353·04	345·53	338·33	331·42
1 9/32	369·91	361·87	354·17	346·79	339·71
1 5/16	378·93	370·69	362·80	355·25	348·0
1 11/32	387·95	379·52	371·44	363·70	356·28
1 3/8	396·97	388·34	380·08	372·16	364·57

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Tensile Strength of Plates 28 tons per square inch. TABLE No. 358.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
ins.	N	N	N	N	N
$1\frac{13}{32}$	392·0	383·47	375·32	367·50	360·0
$1\frac{7}{16}$	400·71	392·0	383·66	375·66	368·0
$1\frac{15}{32}$	409·42	400·52	392·0	383·83	376·0
$1\frac{1}{2}$	418·13	409·04	400·34	392·0	384·0
$1\frac{17}{32}$	426·84	417·56	408·68	400·16	392·0
$1\frac{9}{16}$	435·55	426·08	417·02	408·33	400·0
$1\frac{19}{32}$	444·26	434·60	425·36	416·50	408·0
$1\frac{5}{8}$	452·97	443·13	433·70	424·66	416·0

CYLINDRICAL BOILER SHELLS.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Tensile Strength of Plates 29 tons per square inch. TABLE No. 359.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
ins.	N	N	N	N	N
$1\frac{13}{32}$	406·0	397·17	388·72	380·62	372·85
$1\frac{7}{16}$	415·02	406·0	397·36	389·08	381·14
$1\frac{15}{32}$	424·04	414·82	406·0	397·54	389·42
$1\frac{1}{2}$	433·06	423·65	414·63	406·0	397·71
$1\frac{17}{32}$	442·08	432·47	423·27	414·45	406·0
$1\frac{9}{16}$	451·11	441·30	431·91	422·91	414·28
$1\frac{19}{32}$	460·13	450·13	440·55	431 37	422·57
$1\frac{5}{8}$	469·15	458·95	449·19	439·83	430·85

N = Numeral. % = Calculated percentage strength of joint.
B = Working pressure per square inch in pounds.
D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

Table No. 360.

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 30 tons per square inch.
Numerals and *Nominal* Factors from 4·5 to 4·9.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
inches.	N	N	N	N	N
1/4	74·66	73·04	71·49	70·0	68·57
9/32	84·0	82·17	80·42	78·75	77·14
5/16	93·33	91·30	89·36	87·50	85·71
11/32	102·66	100·43	98·29	96·25	94·28
3/8	112·0	109·56	107·23	105·0	102·85
13/32	121·33	118·69	116·17	113·75	111·42
7/16	130·66	127·82	125·10	122·50	120·0
15/32	140·0	136·95	134·04	131·25	128·57
1/2	149·33	146·08	142·97	140·0	137·14
17/32	158·66	155·21	151·91	148·75	145·71
9/16	168·0	164·34	160·85	157·50	154·28
19/32	177·33	173·47	169·78	166·25	162·85
5/8	186·66	182·60	178·72	175·0	171·42
21/32	196·0	191·74	187·66	183·75	180·0
11/16	205·33	200·87	196·59	192·50	188·57
23/32	214·66	210·0	205·53	201·25	197·14
3/4	224·0	219·13	214·46	210·0	205·71
25/32	233·33	228·26	223·40	218·75	214·28
13/16	242·66	237·39	232·34	227·50	222·85
27/32	252·0	246·52	241·27	236·25	231·42
7/8	261·33	255·65	250·21	245·0	240·0
29/32	270·66	264·78	259·14	253·75	248·57
15/16	280·0	273·91	268·08	262·50	257·14
31/32	289·33	283·04	277·02	271·25	265·71
1	298·66	292·17	285·95	280·0	274·28
1 1/32	308·0	301·30	294·89	288·75	282·85
1 1/16	317·33	310·43	303·83	297·50	291·42
1 3/32	326·66	319·56	312·76	306·25	300·0
1 1/8	336·0	328·69	321·70	315·0	308·57
1 5/32	345·33	337·82	330·63	323·75	317·14
1 3/16	354·66	346·95	339·57	332·50	325·71
1 7/32	364·0	356·08	348·51	341·25	334·28
1 1/4	373·33	365·21	357·44	350·0	342·85
1 9/32	382·66	374·34	366·38	358·75	351·42
1 5/16	392·0	383·47	375·32	367·50	360·0
1 11/32	401·33	392·60	384·25	376·25	368·57
1 3/8	410·66	401·74	393·19	385·0	377·14

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.
Tensile Strength 31 tons per square inch.
Numerals and *Nominal* Factors from 4·5 to 4·9.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
inches.	N	N	N	N	N
1/4	77·24	75·47	73·87	72·33	70·85
9/32	86·90	84·91	83·10	81·37	79·71
5/16	96·55	94·34	92·34	90·41	88·57
11/32	106·21	103·78	101·57	99·45	97·42
3/8	115·86	113·21	110·80	108·50	106·28
13/32	125·52	122·65	120·04	117·54	115·14
7/16	135·17	132·08	129·27	126·58	124·0
15/32	144·83	141·52	138·51	135·62	132·85
1/2	154·48	150·95	147·74	144·66	141·71
17/32	164·14	160·39	156·97	153·70	150·57
9/16	173·80	169·82	166·21	162·75	159·42
19/32	183·45	179·26	175·44	171·79	168·28
5/8	193·11	188·69	184·68	180·83	177·14
21/32	202·76	198·13	193·91	189·87	186·0
11/16	212·42	207·56	203·14	198·91	194·85
23/32	222·07	217·0	212·38	207·95	203·71
3/4	231·73	226·43	221·61	217·0	212·57
25/32	241·38	235·86	230·85	226·04	221·42
13/16	251·04	245·30	240·08	235·08	230·28
27/32	260·70	254·74	249·32	244·12	239·14
7/8	270·35	264·17	258·55	253·16	248·0
29/32	280·01	273·60	267·78	262·20	256·85
15/16	289·66	283·04	277·02	271·25	265·71
31/32	299·32	292·47	286·25	280·29	274·57
1	308·97	301·91	295·49	289·33	283·42
1 1/32	318·63	311·34	304·72	298·37	292·28
1 1/16	328·28	320·78	313·95	307·41	301·14
1 3/32	337·94	330·21	323·19	316·45	311·0
1 1/8	347·60	339·65	332·42	325·50	318·85
1 5/32	357·25	349·08	341·66	334·54	327·71
1 3/16	366·91	358·52	350·99	343·58	336·57
1 7/32	376·56	367·95	360·12	352·62	345·42
1 1/4	386·22	377·39	369·36	361·66	354·28
1 9/32	395·87	386·82	378·59	370·70	363·14
1 5/16	405·53	396·26	387·83	379·75	372·0
1 11/32	415·18	405·69	397·06	388·79	380·85
1 3/8	424·84	415·13	406·29	397·83	389·71

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Tensile Strength of Plates 30 tons per square inch. TABLE No. 362.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
ins.	N	N	N	N	N
$1\frac{13}{32}$	420 0	410·87	402·12	393·75	385·71
$1\frac{7}{16}$	429·33	420·0	411·05	402·50	394·28
$1\frac{15}{32}$	438·66	429·13	420·0	411·25	402·85
$1\frac{1}{2}$	448·0	438·26	428·93	420·0	411·42
$1\frac{17}{32}$	457·33	447·39	437·87	428·75	420·0
$1\frac{9}{16}$	466·66	456·52	446·80	437·50	428·57
$1\frac{19}{32}$	476·0	465·65	455·74	446·25	437·14
$1\frac{5}{8}$	485·33	474·78	464·68	455·0	445·71

CYLINDRICAL BOILER SHELLS.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Numerals and *Nominal* Factors from 4·5 to 4·9

Tensile Strength of Plates 31 tons per square inch. TABLE No. 363.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
ins.	N	N	N	N	N
$1\frac{13}{32}$	434·50	424·56	415·53	406·87	398·57
$1\frac{7}{16}$	444·15	434·0	424·76	415·91	407·42
$1\frac{15}{32}$	453·81	443·43	435·0	424·95	416·28
$1\frac{1}{2}$	463·46	452·87	443·23	434·0	425·14
$1\frac{17}{32}$	473·12	462·30	452·46	443·04	434·0
$1\frac{9}{16}$	482·77	471·74	461·70	452·08	442·85
$1\frac{19}{32}$	492·43	481·17	470·93	461·12	451·71
$1\frac{5}{8}$	502·08	490·60	480·17	470·16	460·57

N = Numeral. % = Calculated percentage strength of joint.
B = Working pressure per square inch in pounds.
D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Steel Plates from $\frac{1}{4}$ inch to $1\frac{3}{8}$ inch thick.

Tensile Strength 32 tons per square inch.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
inches.	N	N	N	N	N
1/4	79·64	77·91	76·25	74·66	73·14
9/32	89·60	87·65	85·78	84·0	82·28
5/16	99·55	97·39	95·32	93·33	91·42
11/32	109·51	107·13	104·85	102·66	100·57
3/8	119·46	116·87	114·38	112·0	109·71
13/32	129·42	126·60	123·91	121·33	118·85
7/16	139·37	136·34	133·44	130·66	127·99
15/32	149·33	146·08	142·97	140·0	137·14
1/2	159·28	155·82	152·51	149·33	146·28
17/32	169·24	165·56	162·04	158·66	155·42
9/16	179·20	175·30	171·57	168·0	164·57
19/32	189·15	185·04	181·10	177·33	173·71
5/8	199·11	194·78	190·63	186·66	182·85
21/32	209·06	204·52	200·17	196·0	191·99
11/16	219·02	214·26	209·70	205·33	201·14
23/32	228·97	224·0	219·23	214·66	210·28
3/4	238·93	233·74	228·76	224·0	219·42
25/32	248·88	243·47	238·29	233·33	228·56
13/16	258·84	253·21	247·83	242·66	237·71
27/32	268·80	262·95	257·36	252·0	246·85
7/8	278·75	272·69	266·89	261·33	255·99
29/32	288·71	282·43	276·42	270·66	265·14
15/16	298·66	292·17	285·95	280·0	274·28
31/32	308·62	301·91	295·49	289·33	283·42
1	318·57	311·65	305·02	298·66	292·56
1 1/32	328·53	321·39	314·55	308·0	301·71
1 1/16	338·48	331·13	324·08	317·33	310·85
1 3/32	348·44	340·87	333·61	326·66	319·99
1 1/8	358·40	350·60	343·15	336·0	329·14
1 5/32	368·35	360·34	352·68	345·33	338·28
1 3/16	378·31	370·08	362·21	354·66	347·42
1 7/32	388·26	379·82	371·74	364·0	356·56
1 1/4	398·22	389·56	381·27	373·33	365·71
1 9/32	408·17	399·30	390·80	382·66	374·85
1 5/16	418·13	409·04	400·34	392·0	383·99
1 11/32	428·08	418·78	409·87	401·33	393·13
1 3/8	438·04	428·52	419·40	410·66	402·28

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Numerals and *Nominal* Factors from 4·5 to 4·9.

Tensile strength of Plates 32 tons per square inch. TABLE No. 365.

Thickness of Plate.	F 4·5	F 4·6	F 4·7	F 4·8	F 4·9
inches.	N	N	N	N	N
$1\frac{13}{32}$	448·0	438·26	428·93	420·0	411·42
$1\frac{7}{16}$	457·95	448·0	438·46	429·33	420·56
$1\frac{15}{32}$	467·91	457·74	448·0	439·66	429·71
$1\frac{1}{2}$	477·86	467·47	457·53	448·0	438·85
$1\frac{17}{32}$	487·82	477·21	467·06	457·33	447·99
$1\frac{9}{16}$	497·77	486·95	476·59	466·66	457·13
$1\frac{19}{32}$	507·73	496·69	486·12	476·0	466·28
$1\frac{5}{8}$	517·68	506·43	495·66	485·33	475·42

N = Numeral. % = Calculated percentage strength of joint.
B = Working pressure per square inch in pounds.
D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 366.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 26 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9

Thickness of Plate.	F 5	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	327·60	321·17	315·0	309·05	303·33	297·81	292·50	287·36	282·41	277·62
$1\frac{7}{16}$	334·88	328·31	322·0	315·92	310·07	304·43	299·0	293·75	288·69	283·79
$1\frac{15}{32}$	342·16	335·45	329·0	322·79	316·81	311·05	305·50	300·14	294·96	289·96
$1\frac{1}{2}$	349·44	342·58	336·0	329·66	323·55	327·67	312·0	306·52	301·24	296·13
$1\frac{17}{32}$	356·72	349·72	343·0	336·52	330·29	334·29	318·50	312·91	307·51	302·30
$1\frac{9}{16}$	364·0	356·86	350·0	343·39	337·03	340·91	325·0	319·29	313·79	308·47
$1\frac{19}{32}$	371·28	364·0	357·0	350·26	343·77	347·52	331·50	325·68	320·06	314·64
$1\frac{5}{8}$	378·56	371·13	364·0	357·13	350·51	354·14	338·0	332·07	326·34	320·81

CYLINDRICAL BOILER SHELLS.

TABLE No. 367.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 26 tons per square inch.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	273·0	268·52	264·19	260·0	255·93	252·0	248·18	244·47	240·88	237·39
$1\frac{7}{16}$	279·06	274·49	270·06	265·77	261·62	257·60	253·69	249·91	246·23	242·66
$1\frac{15}{32}$	285·13	280·46	275·93	271·55	267·31	263·20	259·21	255·34	251·58	247·94
$1\frac{1}{2}$	291·20	286·42	281·80	277·33	273·0	268·80	264·72	260·77	256·94	253·21
$1\frac{17}{32}$	297·26	292·39	287·67	283·11	278·68	274·40	270·24	266·20	262·29	258·49
$1\frac{9}{16}$	303·33	298·36	293·54	288·88	284·37	280·0	275·75	271·64	267·64	263·76
$1\frac{19}{32}$	309·40	304·32	299·41	294·66	290·06	285·60	281·27	276·07	273·0	269.04
$1\frac{5}{8}$	315·46	310·29	305·29	300·44	295·75	291·20	286·78	282·50	278·35	274·31

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 368.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 27 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	340·20	333·53	327·11	320·94	315·0	309·27	303·75	298·42	293·27	288·30
$1\frac{7}{16}$	347·76	340·94	334·38	328·07	322·0	316·14	310·50	305·05	299·79	294·71
$1\frac{15}{32}$	355·32	348·35	341·65	335·20	329·0	323·01	317·25	311·68	306·31	301·11
$1\frac{1}{2}$	362·88	355·76	348·92	342·34	336·0	329·89	324·0	318·31	312·82	307·52
$1\frac{17}{32}$	370·44	363·17	356·19	349·47	343·0	336·76	330·75	324·94	319·34	313·93
$1\frac{9}{16}$	378·0	370·58	363·46	356·60	350·0	343·63	337·50	331·57	325·86	320·33
$1\frac{19}{32}$	385·56	378·0	370·73	363·73	357·0	350·51	344·25	338·21	332·38	326·74
$1\frac{5}{8}$	393·12	385·41	378·0	370·86	364·0	357·38	351·0	344·84	338·89	333·15

CYLINDRICAL BOILER SHELLS.

TABLE No. 369.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 27 tons per square inch.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	283·5	278·85	274·35	270·0	265·78	261·69	257·72	253·88	250·14	246·52
$1\frac{7}{16}$	289·8	285·05	280·45	276·0	271·68	267·50	263·45	259·52	255·70	252·0
$1\frac{15}{32}$	296·1	291·24	286·54	282·0	277·59	273·32	269·18	265·16	261·26	257·47
$1\frac{1}{2}$	302·4	297·44	292·64	288·0	283·50	279·13	274·91	270·80	266·82	262·95
$1\frac{17}{32}$	308·7	303·64	298·74	294·0	289·40	284·95	280·63	276·44	272·38	268·43
$1\frac{9}{16}$	315·0	309·83	304·83	300·0	295·31	290·77	286·36	282·09	277·94	273·91
$1\frac{19}{32}$	321·3	316·03	310·93	306·0	301·21	296·58	292·09	287·73	283·50	279·39
$1\frac{5}{8}$	327·6	322·23	317·03	312·0	307·12	302·40	297·81	293·37	289·05	284·87

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 370.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 28 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	352·80	345·88	339·23	332·83	326·66	320·72	315·0	309·47	304·13	298·98
$1\frac{7}{16}$	360·64	353·56	346·77	340·22	333·92	327·85	322·0	316·35	310·89	305·62
$1\frac{15}{32}$	368·48	361·25	354·31	347·62	341·18	334·98	329·0	323·22	317·65	312·27
$1\frac{1}{2}$	376·32	368·94	361·85	355·01	348·44	342·11	336·0	330·10	324·41	318·91
$1\frac{17}{32}$	384·16	376·62	369·38	362·41	355·70	349·23	343·0	336·98	331·17	325·56
$1\frac{9}{16}$	392·0	384·31	376·92	369·81	362·96	356·36	350·0	343·86	337·93	332·20
$1\frac{19}{32}$	399·84	392·0	384·46	377·20	370·22	363·49	357·0	350·73	344·69	338·84
$1\frac{5}{8}$	407·68	399·68	392·0	384·60	377·48	370·61	364·0	357·61	351·44	345·49

CYLINDRICAL BOILER SHELLS.

TABLE No. 371.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 28 tons per square inch.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6	F 6·1	F 6·2	F 6.3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	294·0	289·18	284·51	280·0	275·62	271·38	267·27	263·28	259·41	255·65
$1\frac{7}{16}$	300·53	295·60	290·83	286·22	281·75	277·41	273·21	269·13	265·17	262·33
$1\frac{15}{32}$	307·06	302·03	297·16	292·44	287·87	283·44	279·15	274·98	270·94	267·01
$1\frac{1}{2}$	313·60	308·45	303·48	298·66	294·0	289·47	285·09	280·83	276·70	272·69
$1\frac{17}{32}$	320·13	314·88	309·80	304·88	300·12	295·50	291·03	285·68	282·47	278·37
$1\frac{9}{16}$	326·66	321·31	316·13	311·11	306·25	301·53	296·97	291·53	288·23	284·05
$1\frac{19}{32}$	333·20	327·73	322·45	317·33	312·37	307·57	302·91	297·38	294·0	289·74
$1\frac{5}{8}$	339·73	334·16	328·77	323·55	318·50	313·60	308·84	303·23	299·76	295·42

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 372.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 29 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	365·40	358·23	351·34	344·71	338·33	332·18	326·25	320·52	315·0	309·66
$1\frac{7}{16}$	373·52	366·19	359·15	352·37	345·85	339·56	333·50	327·65	322·0	316·54
$1\frac{15}{32}$	381·64	374·15	366·96	360·03	353·37	346·94	340·75	334·77	329·0	323·42
$1\frac{1}{2}$	389·76	382·11	374·77	367·69	360·88	354·32	348·0	341·89	336·0	330·30
$1\frac{17}{32}$	397·88	390·07	382·57	375·35	368·40	361·71	355·25	349·01	343·0	337·18
$1\frac{9}{16}$	406·0	398·04	390·38	383·01	375·92	369·09	362·50	356·14	350·0	344·06
$1\frac{19}{32}$	414·12	406·0	398·19	390·68	383·44	376·47	369·75	363·26	357·0	350·95
$1\frac{5}{8}$	422·24	413·96	406·0	398·34	390·96	383·85	377·0	370·38	364·0	357·83

CYLINDRICAL BOILER SHELLS.

TABLE No. 373.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 29 tons per square inch.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	304·50	299·50	294·67	290·0	285·46	281·07	276·81	272·68	268·67	264·78
$1\frac{7}{16}$	311·26	306·16	301·22	296·44	291·81	287·32	282·97	278·74	274·64	270·66
$1\frac{15}{32}$	318·03	312·82	307·77	302·88	298·15	293·57	289·12	284·80	280·61	276·55
$1\frac{1}{2}$	324·80	319·47	314·32	309·33	304·50	299·81	295·27	290·86	286·58	282·43
$1\frac{17}{32}$	331·56	326·13	320·87	315·77	310·84	306·06	301·42	296·92	292·55	288·31
$1\frac{9}{16}$	338·33	332·78	327·42	322·22	317·18	312·30	307·57	302·98	298·53	294·20
$1\frac{19}{32}$	345·10	339·44	333·96	328·66	323·53	318·55	313·72	309·04	304·50	300·08
$1\frac{5}{8}$	351·86	346·09	340·51	335·11	329·87	324·80	319·87	315·10	310·47	305·97

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Table No. 374.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 30 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate	F 5	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	378·0	370·58	363·46	356·60	350·0	343·63	337·50	331·57	385·86	320·33
$1\frac{7}{16}$	386·4	378·82	371·53	364·52	357·77	351·27	345·0	338·94	333·10	327·45
$1\frac{15}{32}$	394·8	387·05	379·61	372·45	365·55	358·91	352·50	346·31	340·34	334·57
$1\frac{1}{2}$	403·2	395·29	387·69	380·37	373·33	366·54	360·0	353·68	347·58	341·69
$1\frac{17}{32}$	411·6	403·53	395·77	388·30	381·11	374·18	367·50	361·05	354·82	348·81
$1\frac{9}{16}$	420·0	411·76	403·84	396·22	388·88	384·81	375·0	368·42	362·06	355·93
$1\frac{19}{32}$	428·4	420·0	411·92	404·15	396·66	389·45	382·5	375·79	369·31	363·05
$1\frac{5}{8}$	436·8	428·23	420·0	412·07	404·44	396·08	390·0	383·15	376·55	370·17

CYLINDRICAL BOILER SHELLS.

Table No. 375.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 30 tons per square inch.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	315·0	309·83	304·83	300·0	295·31	290·77	286·36	282·09	277·94	273·91
$1\frac{7}{16}$	322·0	316·72	311·61	306·66	301·87	297·23	292·72	288·35	284·11	280·0
$1\frac{15}{32}$	329·0	323·60	318·38	313·33	308·43	303·69	299·09	294·62	290·29	286·08
$1\frac{1}{2}$	336·0	330·49	325·16	320·0	315·0	310·15	305·45	309·89	296·47	292·17
$1\frac{17}{32}$	343·0	337·37	331·93	326·66	321·56	316·61	311·81	307·16	302·64	298·26
$1\frac{9}{16}$	350·0	344·26	338·71	333·33	328·12	323·07	318·18	313·43	308·82	304·34
$1\frac{19}{32}$	357·0	351·14	345·48	340·0	334·68	329·53	324·54	319·70	315·0	310·43
$1\frac{5}{8}$	364·0	358·03	352·25	346·66	341·25	336·0	330·91	325·97	321·17	316·52

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 376.

Steel Plates from $1\frac{3}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 31 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	390·60	382·94	375·57	368·49	361·66	355·09	348·75	342·63	336·72	331·01
$1\frac{7}{16}$	399·28	391·45	383·92	376·68	369·70	362·98	356·50	350·24	344·20	333·37
$1\frac{15}{32}$	407·96	399·96	392·27	384·86	377·74	370·87	364·25	357·85	351·69	346·73
$1\frac{1}{2}$	416·64	408·47	400·61	393·05	385·77	378·76	372·0	365·47	359·17	353·08
$1\frac{17}{32}$	425·32	416·98	408·96	401·24	393·81	386·65	379·75	373·08	366·65	360·44
$1\frac{9}{16}$	434·0	425·49	417·30	409·43	401·85	394·54	387·50	380·70	374·13	367·79
$1\frac{19}{32}$	442·68	434·0	425·65	417·62	409·88	402·43	395·25	388·31	381·62	375·15
$1\frac{5}{8}$	451·36	442·51	434·0	425·81	417·92	410·32	403·0	395·93	389·10	382·51

CYLINDRICAL BOILER SHELLS.

TABLE No. 377.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 31 tons per square inch.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	325·50	320·16	315·0	310·0	305·15	300·46	295·91	291·49	287·20	283·04
$1\frac{7}{16}$	332·73	327·27	322·0	316·88	311·93	307·13	302·48	297·97	293·58	289·33
$1\frac{15}{32}$	339·96	334·39	329·0	323·77	318·71	313·81	309·06	304·44	300·97	295·62
$1\frac{1}{2}$	347·2	341·50	336·0	330·66	325·50	320·49	315·63	310·92	306·35	301·91
$1\frac{17}{32}$	354·43	348·62	343·0	337·55	332·28	327·17	322·21	317·40	312·73	308·20
$1\frac{9}{16}$	361·66	355·73	350·0	344·44	339·06	333·84	328·78	323·88	319·11	314·49
$1\frac{19}{32}$	368·90	362·85	357·0	351·33	345·84	340·52	335·36	330·35	325·50	320·78
$1\frac{5}{8}$	376·13	369·96	364·0	358·22	352·62	347·20	341·94	336·83	331·88	327·07

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

CYLINDRICAL BOILER SHELLS.

TABLE No. 378.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 32 tons per square inch.

Numerals and *Nominal* Factors from 5 to 5·9.

Thickness of Plate.	F 5	F 5·1	F 5·2	F 5·3	F 5·4	F 5·5	F 5·6	F 5·7	F 5·8	F 5·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	403·20	395·29	387·69	380·37	373·33	366·53	360·0	353·68	347·58	341·69
$1\frac{7}{16}$	412·16	404·07	396·30	388·83	381·63	374·68	368·0	361·54	355·31	349·28
$1\frac{15}{32}$	421·12	412·86	404·92	397·28	389·92	382·82	376·0	369·40	363·03	356·88
$1\frac{1}{2}$	430·08	421·64	413·53	405·73	398·22	390·97	384·0	377·26	370·75	364·47
$1\frac{17}{32}$	439·04	430·43	422·15	414·18	406·51	399·11	392·0	385·12	378·48	372·06
$1\frac{9}{16}$	448·0	439·21	430·77	422·64	414·81	407·26	400·0	392·98	386·20	379·66
$1\frac{19}{32}$	456·96	448·0	439·38	431·09	423·11	415·40	408·0	400·84	394·93	387·25
$1\frac{5}{8}$	465·92	456·78	448·0	439·54	431·40	423·55	416·0	408·70	401·65	394·84

CYLINDRICAL BOILER SHELLS.

TABLE No. 379.

Steel Plates from $1\frac{13}{32}$ inch to $1\frac{5}{8}$ inch thick.

Tensile Strength 32 tons per square inch.

Numerals and *Nominal* Factors from 6 to 6·9.

Thickness of Plate.	F 6	F 6·1	F 6·2	F 6·3	F 6·4	F 6·5	F 6·6	F 6·7	F 6·8	F 6·9
ins.	N	N	N	N	N	N	N	N	N	N
$1\frac{13}{32}$	336·0	330·49	325·16	320·0	315·0	310·15	305·45	300·89	296·47	292·17
$1\frac{7}{16}$	343·46	337·83	332·38	327·11	322·0	317·04	312·24	307·58	303·05	298·66
$1\frac{15}{32}$	350·93	345·18	339·61	334·22	329·0	323·93	319·03	314·26	309·64	305·16
$1\frac{1}{2}$	358·40	352·52	346·83	341·33	336·0	330·83	325·81	320·95	316·23	311·65
$1\frac{17}{32}$	365·86	359·86	354·06	348·44	343·0	337·72	332·60	327·64	322·82	318·14
$1\frac{9}{16}$	373·33	367·21	361·29	355·55	350·0	344·61	339·39	334·32	329·41	324·63
$1\frac{19}{32}$	380·80	374·55	368·51	362·66	357·0	351·50	346·18	341·01	336·0	331·13
$1\frac{5}{8}$	388·26	381·90	375·74	369·77	364·0	358·40	352·97	347·70	342·58	337·62

N = Numeral. % = Calculated percentage strength of joint. B = Working pressure per square inch in pounds. D = Inside diameter in inches.

$$\frac{N \times \%}{D} = B \qquad \frac{N \times \%}{B} = D \qquad \frac{D \times B}{N} = \% \qquad \frac{D \times B}{\%} = N$$

Copper Steam Pipes (Brazed Joints).

When steam pipes are made of good copper, and the brazing and workmanship are in all respects satisfactory, the working pressure should not exceed that found by the following formula :—

T = Thickness of pipe in inches.
D = Diameter of pipe inside inches.
B = Working pressure per square inch in lbs.

$$\frac{6000 \times (T - 1/16)}{D} = B$$

$$\frac{B \times D}{6000} + 1/16 = T$$

$$\frac{6000 \times (T - 1/16)}{B} = D$$

Copper Steam Pipes (Solid Drawn).

When copper steam pipes are solid drawn, if good copper and free from all defects, and the inside diameter does not exceed 8 inches, the working pressure may be found by the following formula :—

T = Thickness of pipe in inches.
D = Diameter of pipe inside in inches.
B = Working pressure per square inch in lbs.

$$\frac{6000(T - 1/32)}{D} = B$$

$$\frac{B \times D}{6000} + 1/32 = T$$

$$\frac{6000(T - 1/32)}{B} = D$$

Wrought Iron Steam Pipes (Lap Welded).

When steam pipes are made of good wrought iron, and the welding sound and the workmanship in all respects satisfactory, the working pressure may be found by the following formula :—

* T = Thickness of pipe in inches.
D = Diameter of pipe inside in inches.
B = Working pressure per square inch in lbs.

$$\frac{6000 \times T}{D} = B$$

$$\frac{B \times D}{6000} = T$$

$$\frac{6000 \times T}{B} = D$$

* Wrought iron steam pipes should not be made of less thickness than $\frac{1}{4}$ inch

Cast Iron Steam Pipes.

When steam pipes are made out of good cast iron and the casting is sound and of uniform thickness, the working pressure should not exceed that found by the following formula :—

T = Thickness of pipes in inches.
D = Diameter of pipe inside in inches.
B = Working pressure per square inch in lbs.

$$\frac{3500(T - \frac{1}{4})}{D} = B$$

$$\frac{B \times D}{3500} + \frac{1}{4} = T$$

$$\frac{3500(T - \frac{1}{4})}{B} = D$$

Feed Pipes.

All boiler feed pipes should be made for pressures 20 per cent. greater than the working pressure, the pressure in the feed pipes being frequently considerably in excess of that at which the safety valves are loaded.

Testing Steam and Feed Pipes.

All new steam and feed pipes should be tested by hydraulic pressures to about two and a half or three times the working pressure, and should be carefully examined both when the full test pressure is on and after all pressure is off; the full pressure should be kept steadily on for a few minutes.

Cast Iron Evaporators and Feed Heaters.

When evaporators or feed heaters are made of good cast iron, the shells being cylindrical and ends flat, the castings sound and of uniform thickness, the working pressure should not exceed that found by the following formula :—

* T = Thickness in inches.
† D = Diameter inside in inches.
B = Working pressure per square inch in lbs.

Flat Surface.

$$^{*}\ \frac{20000 \times T^2}{D^2} = B$$

$$\sqrt{\frac{B \times D^2}{20000}} = T^{*}$$

$$\sqrt{\frac{20000 \times T^2}{B}} = D^{\dagger}$$

* See note, next page.

Cylindrical Shell,

$$\frac{3500(T - \frac{1}{4})}{D} = B$$

$$\frac{B \times D}{3500} + \frac{1}{4} = T$$

$$\frac{3500(T - \frac{1}{4})}{B} = D$$

See note, next page.

* The thickness of ends of evaporators or feed heaters should not be less than ⅜ inch.

† When the pressure has to be determined for a part of a flat surface which is a square, then in the flat surface formulæ the value of D used should be the diagonal of the square; and when the ends are bolted to the shell the value of D used should equal the diameter of the bolt circle.

All the flanges should be substantial, and there should be a good fillet all round the root; and when the ends and shell are cast solid, there should be a good and substantial fillet inside all round.

The bolts or studs for the ends or doors should not have a greater stress on them than 5000 lbs. per square inch; and the size of bolts or studs should not be less than ¾ inch diameter.

Wrought Iron or Steel Boiler Tubes.

When boiler tubes that are subject to external pressure are made of good iron or steel, have the welding sound and the tubes in all respects satisfactory, and the length does not exceed 9 feet, the working pressure may be found by the following formula :—

‡T = Thickness of tube in inches.
D = Diameter of tube outside in inches.
B = Working pressure per square inch in lbs.

$$\frac{9000(T - \cdot093)}{D} = B$$

$$\frac{B \times D}{9000} + \cdot093 = T$$

$$\frac{9000(T - \cdot093)}{B} = D$$

Brass Boiler Tubes (Solid Drawn).

When boiler tubes that are subject to external pressure are made of good brass, solid drawn, and are found sound and satisfactory in every respect, the working pressure may be ascertained by the following formula :—

T = Thickness of tube in inches.
D = Diameter of tube outside in inches.
B = Working pressure per square inch in lbs.

$$\frac{6000(T - \cdot083)}{D} = B$$

$$\frac{B \times D}{6000} + \cdot083 = T$$

$$\frac{6000(T - \cdot083)}{B} = D$$

‡ The thickness of stay tubes at the bottom of the thread should not be less than ¼ inch.

PITCH OF RIVETS (DIFFERENT DIAMETERS).

Lap Joints.

Different diameters from $\frac{1}{2}$ inch to $1\frac{7}{8}$ inch.

Plates from $\frac{1}{4}$ inch to $1\frac{5}{8}$ inch thick.

Calculated percentage strength of joints.*

The pitch of rivets of different diameters for lap joints, single, double, and treble-riveted, as given in the five Tables, Nos, 380, 381, 382, 383 and 384, immediately following, will facilitate finding a suitable pitch when the diameter of the rivet is not the same as that given in the Tables for Riveted Joints for the thickness of the plate being dealt with, and will be of use in determining the pitch of rivets for circumferential seams when, for practical reasons, it is considered desirable to adopt the same diameter of rivets in the circumferential seams as in the longitudinal seams, although the latter may be of another description of riveting.

The proportions arrived at by the use of the five tables immediately following should *not* be considered those which are recommended for boiler work all round, but are given principally to meet cases such as are alluded to in the previous paragraph with reference to circumferential seams. For well-proportioned riveted joints see Tables Riveted Joints, Steel Plates, and Steel Rivets, more particularly for longitudinal seams; the proportions in the tables for steel plates and steel rivets are as well suited for iron plates and iron rivets as they are for steel. The ratio between the shearing and tensile strength is nearly the same in both cases.

* (*a*) The calculated percentage strength of joints, as given in the five tables immediately following, is only correct when the lap of the joint and also when the vertical distance between the rows of rivets are sufficient (see clause "Diagonal Pitches," page 22); these important points should in all cases be attended to after the pitch and diameter of rivet have been determined. Badly designed circumferential seams have frequently caused delay, trouble, and expense, even to lifting boilers, and in some cases taking them out of vessels and fitting new plates. Circumferential joints should be made suitable for stresses greater than and different from those due to the pressure of the steam only.

PITCH OF RIVETS (DIFFERENT DIAMETERS). TABLE No. 380.

Lap Joints Single Riveted.

Different diameters from $\frac{9}{16}$ inch to $1\frac{1}{8}$ inch.

Plates from $\frac{1}{4}$ inch to $\frac{23}{32}$ inch thick.

Calculated Percentage Strength of Joints.†

Thickness of Plate.	Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.		
T	d	p	%	d	p	%	d	p	%	d	p	%	d	p	%
inches.															
$\frac{1}{4}$	..	..	..	$\frac{9}{16}$	1·379	59·20	$\frac{19}{32}$	1·503	60·49	$\frac{5}{8}$	1·633	61·72	$\frac{21}{32}$	1·767	62·86
$\frac{9}{32}$	..	..	..	$\frac{19}{32}$	1·402	57·64	$\frac{5}{8}$	1·521	58·90	$\frac{21}{32}$	1·644	60·08	$\frac{11}{16}$	1·771	61·18
$\frac{5}{16}$	..	..	..	$\frac{5}{8}$	1·431	56·32	$\frac{21}{32}$	1·545	57·52	$\frac{11}{16}$	1·663	58·65	$\frac{23}{32}$	1·785	59·73
$\frac{11}{32}$	..	..	..	$\frac{21}{32}$	1·464	55·17	$\frac{11}{16}$	1·574	56·32	$\frac{23}{32}$	1·688	57·42	$\frac{3}{4}$	1·805	58·44
$\frac{3}{8}$	..	..	..	$\frac{11}{16}$	1·50	54·16	$\frac{23}{32}$	1·607	55·27	$\frac{3}{4}$	1·717	56·31	$\frac{25}{32}$	1·831	57·33
$\frac{13}{32}$	$\frac{11}{16}$	1·438	52·19	$\frac{23}{32}$	1·539	53·29	$\frac{3}{4}$	1·643	54·35	$\frac{25}{32}$	1·750	55·35	$\frac{13}{32}$	1·860	56·31
$\frac{7}{16}$	$\frac{23}{32}$	1·480	51·43	$\frac{3}{4}$	1·579	52·50	$\frac{25}{32}$	1·681	53·52	$\frac{13}{16}$	1·785	54·48	$\frac{27}{32}$	1·893	55·42
$\frac{15}{32}$	$\frac{3}{4}$	1·524	50·78	$\frac{25}{32}$	1·621	51·80	$\frac{13}{16}$	1·721	52·78	$\frac{27}{32}$	1·823	53·71	$\frac{7}{8}$	1·928	54·61
$\frac{1}{2}$	$\frac{25}{32}$	1·568	50·17	$\frac{13}{16}$	1·664	51·17	$\frac{27}{32}$	1·762	52·11	$\frac{7}{8}$	1·862	53·0	$\frac{29}{32}$	1·965	53·88
$\frac{17}{32}$	*	..	..	$\frac{27}{32}$	1·708	50·60	$\frac{7}{8}$	1·804	51·49	$\frac{29}{32}$	1·903	52·37	$\frac{15}{16}$	2·004	53·21
$\frac{9}{16}$	..	..	..	$\frac{7}{8}$	1·753	50·08	$\frac{29}{32}$	1·848	50·96	$\frac{15}{16}$	1·945	51·79	$\frac{31}{32}$	2·045	52·62
$\frac{19}{32}$	..	..	..	*	..	..	$\frac{15}{16}$	1·892	50·44	$\frac{31}{32}$	1·988	51·27	1	2·086	52·06
$\frac{5}{8}$	..	..	..	..	..	..	*	..	..	1	2·032	50·78	$1\frac{1}{32}$	2·129	51·56
$\frac{21}{32}$	..	..	..	..	..	..	..	..	..	$1\frac{1}{32}$	2·076	50·32	$1\frac{1}{16}$	2·172	51·08
$\frac{11}{16}$	..	..	..	..	..	..	..	..	..	*	..	..	$1\frac{3}{32}$	2·216	50·64
$\frac{23}{32}$	*	..	..	..	..	..	..	..	..	..	..	..	$1\frac{1}{8}$	2·261	50·24
													*		

T = Thickness of plate in inches. d = Diameter of rivets in inches. p = Pitch of rivets in inches. % = Calculated percentage strength of joint.

* When plates are thicker than that for which pitches are given in the Table, the pitches should be made not less than twice the diameter of the rivet, in order that the heads of the rivets may be of sufficient size.

† See Note (*a*) on page 562.

 PITCH OF RIVETS (DIFFERENT DIAMETERS). TABLE No. 381.

Lap Joints Double Riveted.

Different diameters from 25/32 inch to 1 25/32 inch.

Plates from 5/8 inch to 1 5/8 inch thick.

Calculated Percentage Strength of Joints.†

Thickness of Plate.	Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.		
T	d	p	%	d	p	%	d	p	%	d	p	%
1/4	..	..	..	..	..	..	..	..	..	..	..	..
9/32	..	..	..	..	..	..	..	..	..	..	..	..
5/16	..	..	..	..	..	..	..	..	..	..	..	..
11/32	..	..	..	..	..	..	..	..	..	..	..	..
3/8	..	..	..	..	..	..	..	..	..	..	..	..
13/32	..	..	..	..	..	..	..	..	..	..	..	..
7/16	..	..	..	..	..	..	..	..	..	..	..	..
15/32	..	..	..	..	..	..	..	..	..	..	..	..
1/2	..	..	..	..	..	..	..	..	..	..	..	..
17/32	..	..	..	..	..	..	..	..	..	..	..	..
9/16	..	..	..	..	..	..	..	..	..	..	..	..
19/32	..	..	..	..	..	..	..	..	..	..	..	..
5/8	..	..	..	..	..	..	..	..	..	25/32	2·041	61·72
21/32	..	..	..	..	..	..	..	..	..	13/16	2·110	61·49
11/16	..	..	..	..	..	..	..	..	..	27/32	2·179	61·27
23/32	..	..	..	..	..	..	..	..	..	7/8	2·249	61·09
3/4	..	..	..	..	..	..	7/8	2·192	60·08	29/32	2·319	60·92
25/32	..	..	..	..	..	..	29/32	2·262	59·93	15/16	2·389	60·75
13/16	..	..	..	..	..	..	15/16	2·333	59·81	31/32	2·459	60·60
27/32	..	..	..	..	..	..	31/32	2·403	59·68	1	2·529	60·45
7/8	..	..	..	31/32	2·352	58·81	1	2·474	59·57	1 1/32	2·599	60·32
29/32	..	..	..	1	2·423	58·72	1 1/32	2·545	59·47	1 1/16	2·669	60·19
15/16	..	..	..	1 1/32	2·494	58·65	1 1/16	2·616	59·38	1 3/32	2·740	60·08
31/32	..	..	..	1 1/16	2·566	58·59	1 3/32	2·687	59·29	1 1/8	2·810	59·96
1	1 1/16	2·519	57·82	1 3/32	2·637	58·52	1 1/8	2·758	59·20	1 5/32	2·881	59·86
1 1/32	1 3/32	2·590	57·77	1 1/8	2·708	58·45	1 5/32	2·828	59·11	1 3/16	2·951	59·75
1 1/16	1 1/8	2·661	57·72	1 5/32	2·779	58·39	1 3/16	2·899	59·03	1 7/32	3·022	59·67
1 3/32	1 5/32	2·733	57·69	1 3/16	2·851	58·34	1 7/32	2·971	58·97	1 1/4	3·093	59·58
1 1/8	1 3/16	2·804	57·64	1 7/32	2·922	58·29	1 1/4	3·042	58·90	1 9/32	3·164	59·50
1 5/32	1 7/32	2·876	57·62	1 1/4	2·933	58·23	1 9/32	3·113	58·84	1 5/16	3·234	59·41
1 3/16	1 1/4	2·947	57·58	1 9/32	3·064	58·18	1 5/16	3·184	58·77	1 11/32	3·305	59·34
1 7/32	1 9/32	3·019	57·56	1 5/16	3·136	58·14	1 11/32	3·254	58·70	1 3/8	3·376	59·27
1 1/4	1 5/16	3·090	57·52	1 11/32	3·207	58·09	1 3/8	3·326	58·65	1 13/32	3·447	59·20
1 9/32	1 11/32	3·162	57·50	1 3/8	3·278	58·05	1 13/32	3·397	58·60	1 7/16	3·518	59·13
1 5/16	1 3/8	3·233	57·46	1 13/32	3·350	58·02	1 7/16	3·469	58·56	1 15/32	3·589	59·07
1 11/32	1 13/32	3·305	57·45	1 7/16	3·421	57·98	1 15/32	3·540	58·51	1 1/2	3·660	59·01
1 3/8	1 7/16	3·376	57·42	1 15/32	3·493	57·95	1 1/2	3·611	58·46	1 17/32	3·731	58·95
1 13/32	1 15/32	3·448	57·40	1 1/2	3·564	57·91	1 17/32	3·682	58·41	1 9/16	3·802	58·90
1 7/16	1 1/2	3·519	57·37	1 17/32	3·635	57·87	1 9/16	3·753	58·36	1 19/32	3·873	58·84
1 15/32	1 17/32	3·590	57·34	1 9/16	3·707	57·85	1 19/32	3·825	58·33	1 5/8	3·944	58·79
1 1/2	1 9/16	3·662	57·33	1 19/32	3·778	57·81	1 5/8	3·896	58·29	1 21/32	4·015	58·74
1 17/32	1 19/32	3·734	57·31	1 5/8	3·850	57·79	1 21/32	3·967	58·24	1 11/16	4·087	58·71
1 9/16	1 5/8	3·805	57·29	1 21/32	3·921	57·75	1 11/16	4·039	58·21	1 23/32	4·158	58·66
1 19/32	1 21/32	3·877	57·28	1 11/16	3·992	57·72	1 23/32	4·110	58·18	1 3/4	4·229	58·61
1 5/8	1 11/16	3·948	57·25	1 23/32	4·064	57·70	1 3/4	4·181	58·14	1 25/32	4·300	58·57

T = Thickness of plate in inches. d = Diameter of rivets in inches.
p = Pitch of rivets in inches. % = Calculated percentage strength of joint.†

† See Note (a) on page 562.

PITCH OF RIVETS (DIFFERENT DIAMETERS). TABLE No. 382.

Lap Joints Double Riveted.

Different diameters of Rivets from $\frac{1}{2}$ inch to $1\frac{15}{16}$ inch.
Plates from $\frac{1}{4}$ inch to $1\frac{5}{8}$ inch thick.
Calculated Percentage Strength of Joints.†

Thickness of Plate.	Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.		
T	d	p	%	d	p	%	d	p	%	d	p	%	d	p	%
inches.															
1/4	..	..	..	..	..	..	1/2	1·790	72·06	17/32	1·987	73·26	9/16	2·195	74·37
9/32	..	..	..	..	..	..	17/32	1·826	70·90	9/16	2·014	72·07	19/32	2·211	73·14
5/16	..	..	..	..	..	..	9/16	1·868	69·88	19/32	2·049	71·02	5/8	2·237	72·06
11/32	..	..	..	..	..	..	19/32	1·917	69·02	5/8	2·091	70·10	21/32	2·272	71·11
3/8	..	..	..	19/32	1·806	67·12	5/8	1·969	68·25	21/32	2·138	69·30	11/16	2·313	70·27
13/32	..	..	..	5/8	1·865	66·48	21/32	2·024	67·57	11/16	2·188	68·57	23/32	2·359	69·53
7/16	..	..	..	21/32	1·926	65·92	11/16	2·081	66·96	23/32	2·242	67·94	3/4	2·408	68·85
15/32	..	..	..	11/16	1·988	65·41	23/32	2·140	66·41	3/4	2·298	67·36	25/32	2·461	68·25
1/2	11/16	1·907	63·94	23/32	2·051	64·95	3/4	2·201	65·92	25/32	2·356	66·83	13/16	2·516	67·70
17/32	23/32	1·973	63·57	3/4	2·116	64·55	25/32	2·263	65·47	13/16	2·415	66·35	27/32	2·572	67·19
9/16	3/4	2·040	63·23	25/32	2·181	64·17	13/16	2·326	65·06	27/32	2·476	65·92	7/8	2·631	66·74
19/32	25/32	2·107	62·92	13/16	2·247	63·84	27/32	2·390	64·69	7/8	2·538	65·52	29/32	2·691	66·32
5/8	13/16	2·175	62·64	27/32	2·313	63·52	7/8	2·455	64·35	29/32	2·601	65·15	15/16	2·751	65·92
21/32	27/32	2·243	62·38	7/8	2·380	63·23	29/32	2·521	64·05	15/16	2·665	64·82	31/32	2·813	65·56
11/16	7/8	2·311	62·13	29/32	2·447	62·96	15/16	2·587	63·76	31/32	2·730	64·51	1	2·876	65·22
23/32	29/32	2·380	61·92	15/16	2·515	62·72	31/32	2·653	63·48	1	2·795	64·22	1 1/32	2·940	64·92
3/4	15/16	2·449	61·71	31/32	2·583	62·49	1	2·720	63·23	1 1/32	2·860	63·94	1 1/16	3·004	64·63
25/32	31/32	2·518	61·52	1	2·651	62·27	1 1/32	2·787	62·99	1 1/16	2·926	63·68	1 3/32	3·069	64·36
13/16	1	2·588	61·36	1 1/32	2·720	62·08	1 1/16	2·855	62·78	1 3/32	2·993	63·45	1 1/8	3·134	64·10
27/32	1 1/32	2·657	61·18	1 1/16	2·788	61·89	1 3/32	2·923	62·58	1 1/8	3·060	63·23	1 5/32	3·200	63·86
7/8	1 1/16	2·727	61·03	1 3/32	2·857	61·71	1 1/8	2·991	62·38	1 5/32	3·127	63·02	1 3/16	3·266	63·64
29/32	1 3/32	2·796	60·88	1 1/8	2·926	61·55	1 5/32	3·059	62·20	1 3/16	3·195	62·83	1 7/32	3·333	63·43
15/16	1 1/8	2·866	60·74	1 5/32	2·996	61·40	1 3/16	3·128	62·03	1 7/32	3·263	62·64	1 1/4	3·400	63·23
31/32	1 5/32	2·936	60·61	1 3/16	3·065	61·25	1 7/32	3·197	61·87	1 1/4	3·331	62·47	1 9/32	3·467	63·04
1	1 3/16	3·006	60·49	1 7/32	3·135	61·12	1 1/4	3·266	61·72	1 9/32	3·399	62·30	1 5/16	3·535	62·87
1 1/32	1 7/32	3·077	60·39	1 1/4	3·205	60·99	1 9/32	3·335	61·58	1 5/16	3·467	62·14	1 11/32	3·603	62·70
1 1/16	1 1/4	3·147	60·27	1 9/32	3·274	60·86	1 5/16	3·404	61·44	1 11/32	3·536	61·99	1 3/8	3·670	62·53
1 3/32	1 9/32	3·217	60·17	1 5/16	3·344	60·75	1 11/32	3·473	61·30	1 3/8	3·605	61·85	1 13/32	3·739	62·38
1 1/8	1 5/16	3·288	60·08	1 11/32	3·414	60·64	1 3/8	3·543	61·19	1 13/32	3·674	61·72	1 7/16	3·807	62·24
1 5/32	1 11/32	3·358	59·98	1 3/8	3·484	60·53	1 13/32	3·613	61·07	1 7/16	3·743	61·59	1 15/32	3·876	62·10
1 3/16	1 3/8	3·429	59·90	1 13/32	3·555	60·44	1 7/16	3·682	60·95	1 15/32	3·812	61·47	1 1/2	3·944	61·96
1 7/32	1 13/32	3·499	59·81	1 7/16	3·625	60·34	1 15/32	3·752	60·85	1 1/2	3·882	61·36	1 17/32	4·013	61·84
1 1/4	1 7/16	3·570	59·73	1 15/32	3·695	60·25	1 1/2	3·822	60·75	1 17/32	3·951	61·24	1 9/16	4·082	61·72
1 9/32	1 15/32	3·641	59·66	1 1/2	3·765	60·15	1 17/32	3·892	60·65	1 9/16	4·021	61·14	1 19/32	4·151	61·60
1 5/16	1 1/2	3·711	59·57	1 17/32	3·836	60·08	1 9/16	3·962	60·57	1 19/32	4·090	61·03	1 5/8	4·220	61·49
1 11/32	1 17/32	3·782	59·51	1 9/16	3·906	60·00	1 19/32	4·032	60·47	1 5/8	4·160	60·93	1 21/32	4·290	61·39
1 3/8	1 9/16	3·853	59·44	1 19/32	3·977	59·92	1 5/8	4·102	60·38	1 21/32	4·230	60·84	1 11/16	4·359	61·28
1 13/32	1 19/32	3·924	59·38	1 5/8	4·047	59·84	1 21/32	4·173	60·31	1 11/16	4·300	60·75	1 23/32	4·429	61·19
1 7/16	1 5/8	3·995	59·32	1 21/32	4·118	59·77	1 11/16	4·243	60·22	1 23/32	4·370	60·67	1 3/4	4·498	61·09
1 15/32	1 21/32	4·066	59·26	1 11/16	4·189	59·71	1 23/32	4·313	60·14	1 3/4	4·440	60·58	1 25/32	4·568	61·00
1 1/2	1 11/16	4·137	59·20	1 23/32	4·259	59·64	1 3/4	4·384	60·08	1 25/32	4·510	60·50	1 13/16	4·638	60·92
1 17/32	1 23/32	4·207	59·14	1 3/4	4·330	59·58	1 25/32	4·454	60·00	1 13/16	4·580	60·42	1 27/32	4·708	60·83
1 9/16	1 3/4	4·279	59·10	1 25/32	4·401	59·52	1 13/16	4·525	59·94	1 27/32	4·650	60·34	1 7/8	4·778	60·75
1 19/32	1 25/32	4·350	59·05	1 13/16	4·472	59·47	1 27/32	4·595	59·87	1 7/8	4·721	60·28	1 29/32	4·848	60·67
1 5/8	1 13/16	4·421	59·00	1 27/32	4·543	59·41	1 7/8	4·666	59·81	1 29/32	4·791	60·21	1 15/16	4·918	60·60

T = Thickness of plate in inches. d = Diameter of rivets in inches.
p = Pitch of rivets in inches. % = Calculated percentage strength of joint.†

† See Note (a) on page 562.

Lap Joints Treble Riveted.

Different Diameters from $\frac{23}{32}$ inch to $1\frac{23}{32}$ inch.

Plates from $\frac{5}{8}$ inch to $1\frac{5}{8}$ inch thick.

Calculated Percentage Strength of Joints.†

Thickness of Plate.	Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.		
T	d	p	%	d	p	%	d	p	%	d	p	%
$\frac{5}{16}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{11}{32}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{3}{8}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{13}{32}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{7}{16}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{15}{32}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{1}{2}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{17}{32}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{9}{16}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{19}{32}$	..	..	..	..	..	..	..	..	..	..	..	..
$\frac{5}{8}$	..	..	..	..	..	..	..	..	..	$\frac{23}{32}$	2·318	68·99
$\frac{21}{32}$	..	..	..	..	..	..	..	..	..	$\frac{3}{4}$	2·408	68·85
$\frac{11}{16}$	..	..	..	..	..	..	..	..	..	$\frac{25}{32}$	2·499	68·73
$\frac{23}{32}$	..	..	..	..	..	..	..	..	..	$\frac{13}{16}$	2·590	68·62
$\frac{3}{4}$	..	..	..	..	..	..	$\frac{13}{16}$	2·516	67·70	$\frac{27}{32}$	2·680	68·51
$\frac{25}{32}$	..	..	..	..	..	..	$\frac{27}{32}$	2·607	67·63	$\frac{7}{8}$	2·771	68·42
$\frac{13}{16}$	..	..	..	..	..	..	$\frac{7}{8}$	2·698	67·56	$\frac{29}{32}$	2·862	68·33
$\frac{27}{32}$	..	..	..	..	..	..	$\frac{29}{32}$	2·790	67·51	$\frac{15}{16}$	2·953	68·25
$\frac{7}{8}$	..	..	..	$\frac{29}{32}$	2·722	66·70	$\frac{15}{16}$	2·881	67·45	$\frac{31}{32}$	3·044	68·17
$\frac{29}{32}$	..	..	..	$\frac{15}{16}$	2·814	66·68	$\frac{31}{32}$	2·973	67·41	1	3·135	68·10
$\frac{15}{16}$	..	..	..	$\frac{31}{32}$	2·906	66·66	1	3·064	67·36	$1\frac{1}{32}$	3·226	68·03
$\frac{31}{32}$	..	..	..	1	2·997	66·63	$1\frac{1}{32}$	3·155	67·31	$1\frac{1}{16}$	3·317	67·96
1	1	2·935	65·93	$1\frac{1}{32}$	3·089	66·61	$1\frac{1}{16}$	3·247	67·27	$1\frac{3}{32}$	3·409	67·91
$1\frac{1}{32}$	$1\frac{1}{32}$	3·027	65·93	$1\frac{1}{16}$	3·181	66·59	$1\frac{3}{32}$	3·339	67·24	$1\frac{1}{8}$	3·50	67·85
$1\frac{1}{16}$	$1\frac{1}{16}$	3·119	65·93	$1\frac{3}{32}$	3·272	66·57	$1\frac{1}{8}$	3·430	67·20	$1\frac{5}{32}$	3·591	67·82
$1\frac{3}{32}$	$1\frac{3}{32}$	3·210	65·93	$1\frac{1}{8}$	3·364	66·55	$1\frac{5}{32}$	3·522	67·17	$1\frac{3}{16}$	3·682	67·74
$1\frac{1}{8}$	$1\frac{1}{8}$	3·302	65·93	$1\frac{5}{32}$	3·456	66·54	$1\frac{3}{16}$	3·613	67·13	$1\frac{7}{32}$	3·774	67·70
$1\frac{5}{32}$	$1\frac{5}{32}$	3·394	65·93	$1\frac{3}{16}$	3·547	66·52	$1\frac{7}{32}$	3·705	67·10	$1\frac{1}{4}$	3·865	67·65
$1\frac{3}{16}$	$1\frac{3}{16}$	3·485	65·93	$1\frac{7}{32}$	3·639	66·50	$1\frac{1}{4}$	3·796	67·07	$1\frac{9}{32}$	3·956	67·61
$1\frac{7}{32}$	$1\frac{7}{32}$	3·577	65·93	$1\frac{1}{4}$	3·731	66·49	$1\frac{9}{32}$	3·888	67·04	$1\frac{5}{16}$	4·048	67·57
$1\frac{1}{4}$	$1\frac{1}{4}$	3·669	65·93	$1\frac{9}{32}$	3·823	66·48	$1\frac{5}{16}$	3·979	67·01	$1\frac{11}{32}$	4·139	67·53
$1\frac{9}{32}$	$1\frac{9}{32}$	3·761	65·93	$1\frac{5}{16}$	3·914	66·46	$1\frac{11}{32}$	4·071	66·99	$1\frac{3}{8}$	4·230	67·49
$1\frac{5}{16}$	$1\frac{5}{16}$	3·852	65·93	$1\frac{11}{32}$	4·006	66·45	$1\frac{3}{8}$	4·162	66·96	$1\frac{13}{32}$	4·322	67·46
$1\frac{11}{32}$	$1\frac{11}{32}$	3·944	65·93	$1\frac{3}{8}$	4·098	66·44	$1\frac{13}{32}$	4·254	66·94	$1\frac{7}{16}$	4·413	67·42
$1\frac{3}{8}$	$1\frac{3}{8}$	4·036	65·93	$1\frac{13}{32}$	4·190	66·43	$1\frac{7}{16}$	4·346	66·92	$1\frac{15}{32}$	4·505	67·39
$1\frac{13}{32}$	$1\frac{13}{32}$	4·127	65·93	$1\frac{7}{16}$	4·294	66·42	$1\frac{15}{32}$	4·437	66·89	$1\frac{1}{2}$	4·596	67·36
$1\frac{7}{16}$	$1\frac{7}{16}$	4·219	65·93	$1\frac{15}{32}$	4·373	66·41	$1\frac{1}{2}$	4·529	66·88	$1\frac{17}{32}$	4·688	67·33
$1\frac{15}{32}$	$1\frac{15}{32}$	4·311	65·93	$1\frac{1}{2}$	4·464	66·39	$1\frac{17}{32}$	4·620	66·85	$1\frac{9}{16}$	4·779	67·30
$1\frac{1}{2}$	$1\frac{1}{2}$	4·403	65·93	$1\frac{17}{32}$	4·556	66·38	$1\frac{9}{16}$	4·712	66·83	$1\frac{19}{32}$	4·871	67·28
$1\frac{17}{32}$	$1\frac{17}{32}$	4·494	65·93	$1\frac{9}{16}$	4·648	66·38	$1\frac{19}{32}$	4·804	66·82	$1\frac{5}{8}$	4·962	67·25
$1\frac{9}{16}$	$1\frac{9}{16}$	4·586	65·93	$1\frac{19}{32}$	4·739	66·36	$1\frac{5}{8}$	4·895	66·80	$1\frac{21}{32}$	5·054	67·22
$1\frac{19}{32}$	$1\frac{19}{32}$	4·678	65·93	$1\frac{5}{8}$	4·831	66·36	$1\frac{21}{32}$	4·987	66·78	$1\frac{11}{16}$	5·145	67·20
$1\frac{5}{8}$	$1\frac{5}{8}$	4·770	65·93	$1\frac{21}{32}$	4·923	66·36	$1\frac{11}{16}$	5·079	66·77	$1\frac{23}{32}$	5·237	67·18

T = Thickness of plate in inches. d = Diameter of rivets in inches.
p = Pitch of rivets in inches. % = Calculated percentage strength of joints.†

† See Note (a) on page 562.

PITCH OF RIVETS (DIFFERENT DIAMETERS). TABLE No. 384.

Lap Joints Treble Riveted.

Different diameters from $\frac{1}{2}$ inch to $1\frac{7}{8}$ inch.

Plates from $\frac{5}{16}$ inch to $1\frac{5}{8}$ inch thick.

Calculated Percentage Strength of Joint.†

Thickness of Plate.	Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.			Diameter of Rivets, Pitches, Percentage of Joints.		
T		p	%	d	p	%	d	p	%	d	p	%	d	p	%
5/16	..	..	..	..	..	..	1/2	2·048	75·58	17/32	2·279	76·68	9/16	2·522	77·69
11/32	..	..	..	..	..	..	17/32	2·120	74·94	9/16	2·343	75·99	19/32	2·578	76·96
3/8	..	..	..	17/32	1·987	73·26	9/16	2·195	74·37	19/32	2·413	75·39	5/8	2·641	76·33
13/32	..	..	..	9/16	2·069	72·81	19/32	2·273	73·87	5/8	2·486	74·85	21/32	2·707	75·75
7/16	..	..	..	19/32	2·153	72·42	5/8	2·353	73·43	21/32	2·561	74·37	11/16	2·778	75·25
15/32	..	..	..	5/8	2·237	72·06	21/32	2·434	73·03	11/16	2·639	73·94	23/32	2·851	74·78
1/2	5/8	2·137	70·75	21/32	2·323	71·74	11/16	2·517	72·68	23/32	2·718	73·55	3/4	2·927	74·37
17/32	21/32	2·225	70·50	11/16	2·409	71·46	23/32	2·60	72·35	3/4	2·799	73·24	25/32	3·004	73·99
9/16	11/16	2·313	70·27	23/32	2·496	71·20	3/4	2·685	72·06	25/32	2·881	72·88	13/16	3·083	73·64
19/32	23/32	2·402	70·07	3/4	2·583	70·96	25/32	2·770	71·79	13/16	2·964	72·58	27/32	3·164	73·33
5/8	3/4	2·491	69·89	25/32	2·671	70·75	13/16	2·856	71·55	27/32	3·048	72·31	7/8	3·245	73·03
21/32	25/32	2·581	69·73	13/16	2·759	70·55	27/32	2·943	71·33	7/8	3·133	72·07	29/32	3·328	72·76
11/16	13/16	2·670	69·56	27/32	2·847	70·36	7/8	3·030	71·12	29/32	3·218	71·83	15/16	3·411	72·51
23/32	27/32	2·760	69·42	7/8	2·936	70·19	29/32	3·117	70·92	15/16	3·304	71·62	31/32	3·495	72·28
3/4	7/8	2·850	69·29	29/32	3·025	70·04	15/16	3·205	70·74	31/32	3·390	71·42	1	3·580	72·06
25/32	29/32	2·940	69·17	15/16	3·114	69·89	31/32	3·293	70·58	1	3·477	71·23	1 1/32	3·665	71·[illegible]6
13/16	15/16	3·031	69·06	31/32	3·204	69·76	1	3·382	70·43	1 1/32	3·564	71·06	1 1/16	3·751	71·67
27/32	31/32	3·121	68·96	1	3·293	69·63	1 1/32	3·470	70·28	1 1/16	3·652	70·90	1 3/32	3·837	71·49
7/8	1	3·211	68·85	1 1/32	3·383	69·51	1 1/16	3·559	70·14	1 3/32	3·739	70·74	1 1/8	3·924	71·33
29/32	1 1/32	3·302	68·76	1 1/16	3·473	69·40	1 3/32	3·648	70·01	1 1/8	3·827	70·60	1 5/32	4·011	71·17
15/16	1 1/16	3·393	68·68	1 3/32	3·563	69·30	1 1/8	3·737	69·89	1 5/32	3·916	70·47	1 3/16	4·098	71·02
31/32	1 3/32	3·483	68·59	1 1/8	3·653	69·20	1 5/32	3·827	69·78	1 3/16	4·004	70·34	1 7/32	4·186	70·88
1	1 1/8	3·574	68·52	1 5/32	3·743	69·10	1 3/16	3·916	69·67	1 7/32	4·093	70·22	1 1/4	4·274	70·75
1 1/32	1 5/32	3·665	68·42	1 3/16	3·834	69·02	1 7/32	4·006	69·57	1 1/4	4·182	70·11	1 9/32	4·362	70·62
1 1/16	1 3/16	3·756	68·38	1 7/32	3·924	68·94	1 1/4	4·096	69·48	1 9/32	4·271	70·0	1 5/16	4·450	70·50
1 3/32	1 7/32	3·847	68·31	1 1/4	4·015	68·86	1 9/32	4·186	69·39	1 5/16	4·360	69·89	1 11/32	4·539	70·39
1 1/8	1 1/4	3·938	68·25	1 9/32	4·105	68·78	1 5/16	4·276	69·30	1 11/32	4·450	69·80	1 3/8	4·627	70·28
1 5/32	1 9/32	4·029	68·19	1 5/16	4·196	68·72	1 11/32	4·366	69·22	1 3/8	4·539	69·70	1 13/32	4·716	70·18
1 3/16	1 5/16	4·120	68·14	1 11/32	4·286	68·64	1 3/8	4·456	69·14	1 13/32	4·629	69·62	1 7/16	4·805	70·08
1 7/32	1 11/32	4·211	68·08	1 3/8	4·377	68·58	1 13/32	4·546	69·06	1 7/16	4·719	69·53	1 15/32	4·894	69·98
1 1/4	1 3/8	4·302	68·03	1 13/32	4·468	68·52	1 7/16	4·637	68·99	1 15/32	4·808	69·45	1 1/2	4·983	69·89
1 9/32	1 13/32	4·393	67·98	1 7/16	4·559	68·46	1 15/32	4·727	68·92	1 1/2	4·898	69·37	1 17/32	5·073	69·81
1 5/16	1 7/16	4·484	67·94	1 15/32	4·649	68·40	1 1/2	4·817	68·86	1 17/32	4·988	69·30	1 9/16	5·162	69·73
1 11/32	1 15/32	4·575	67·89	1 1/2	4·740	68·35	1 17/32	4·908	68·80	1 9/16	5·078	69·23	1 19/32	5·252	69·65
1 3/8	1 1/2	4·667	67·85	1 17/32	4·831	68·30	1 9/16	4·999	68·74	1 19/32	5·169	69·16	1 5/8	5·341	69·57
1 13/32	1 17/32	4·758	67·81	1 9/16	4·922	68·25	1 19/32	5·089	68·68	1 5/8	5·259	69·09	1 21/32	5·431	69·50
1 7/16	1 9/16	4·849	67·77	1 19/32	5·013	68·20	1 5/8	5·180	68·62	1 21/32	5·349	69·03	1 11/16	5·521	69·43
1 15/32	1 19/32	4·940	67·73	1 5/8	5·104	68·16	1 21/32	5·271	68·57	1 11/16	5·440	68·97	1 23/32	5·611	69·36
1 1/2	1 5/8	5·032	67·70	1 21/32	5·195	68·11	1 11/16	5·361	68·52	1 23/32	5·530	68·91	1 3/4	5·701	69·30
1 17/32	1 21/32	5·123	67·67	1 11/16	5·286	68·07	1 23/32	5·452	68·47	1 3/4	5·620	68·86	1 25/32	5·791	69·24
1 9/16	1 11/16	5·214	67·63	1 23/32	5·377	68·03	1 3/4	5·543	68·42	1 25/32	5·711	68·81	1 13/16	5·881	69·18
1 19/32	1 23/32	5·306	67·60	1 3/4	5·469	68·0	1 25/32	5·634	68·38	1 13/16	5·802	68·76	1 27/32	5·972	69·12
1 5/8	1 3/4	5·397	67·57	1 25/32	5·560	67·96	1 13/16	5·725	68·34	1 27/32	5·892	68·70	1 7/8	6·072	69·08

T = Thickness of plate in inches. d = Diameter of rivets in inches.
p = Pitch of rivets in inches. % = Calculated percentage strength of joint.†

† See Note (a) on page 562.

FURNACES—MORISON'S SUSPENSION CYLINDRICAL.

Steel plates from $\frac{1}{4}$ inch to $\frac{5}{8}$ inch thick.

By the Tables Nos. 385 and 386, which immediately follow, the maximum diameter, the working pressure and the thickness of the plate can be determined when the plates of which the furnaces are made are of the best mild steel, not less than $\frac{5}{16}$ inch thick.

The tables are only intended for furnaces which are machine made, practically cylindrical, the pitch of the corrugations not more than 8 inches, the length of the plain parts at the ends not more than 5 inches, and provided the depth of the corrugations from the top outside to the bottom of the corrugations inside be not less than 2 inches ; the plain parts should not be unduly thinned in flanging, and it is desirable that the plates be rolled a little thicker at the ends, so as to allow for the thinning in flanging or for trueing up by machine when the furnace is fitted in a flanged mouthpiece in the tube plate.

The diameter used for determining the pressure or thickness is the outside diameter measured from the bottom of the corrugations, or the minimum inside diameter *plus* twice the thickness of the plate.

D = Outside diameter in inches at the bottom of corrugations.
T = Thickness in inches.
B = Working pressure in lbs. per square inch.

The maximum diameter in inches which a Morison Suspension Furnace should be made, when constructed of the best mild steel plates (provided the thickness of the plate and the working pressure has been determined), is found in the column under the given thickness of plate and opposite the given pressure ; or, if the pressure and diameter be determined, the thickness the plate should be is found at the head of the column above the given diameter, which is found opposite the given pressure ; or the pressure for a given thickness and diameter is that opposite the given diameter, which is in the column under the given thickness.

If 165 lbs. be the pressure required and the thickness of the steel plate be $\frac{5}{8}$ inch, and the outside diameter at the bottom of the corrugations has to be determined :—

Then opposite 165 lbs., the pressure, and in column under $\frac{5}{8}$ inch thickness, 51·13 is found, which is the outside diameter at the bottom of the corrugations in inches, or say

$$51\tfrac{1}{8} = D.$$

If the pressure is required to be 165 lbs. and the outside diameter at the bottom of the corrugations 46 inches, and the thickness of the plate has to be determined :—

Then opposite 165 lbs., the pressure, the diameter outside at the bottom of the corrugations 46·02 inches (which is practically 46 inches), is found in the column under $^9/_{16}$ inches, which is the minimum thickness the plate should be :—

$$^9/_{16} \text{ inch} = T.$$

If the working pressure has to be determined when the thickness of the plate is ⅝ inch, and the outside diameter at the bottom of the corrugations is 48¼ inches :—

Then in column under ⅝ inch, the thickness 48·21 (which is practically 48¼), the diameter is found, and opposite it the pressure 170 lbs., which is the maximum working pressure in lbs. :—

$$170 = B.$$

The furnace to which these remarks refer is generally known as Morison's Furnace, or "Morison's Suspension Furnace"; it has been in use for a few years, and is one among four types generally used for high pressures in marine boilers, and the latest type in the market.

FURNACES, MORISON'S SUSPENSION, CYLINDRICAL.

TABLE No. 385.

Steel Plates from $\frac{1}{4}$ inch to $\frac{7}{16}$ inch thick.
Pressures and Diameters when *Machine* made.

Pressure per square inch.	Thicknesses and Diameters.*						
	¼ in.	9/32 in.	5/16 in.	11/32 in.	⅜ in.	13/32 in.	7/16 in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs.							
60	56·25	...	...	...	...	...	...
65	51·92	58·41	...	...	...	...	...
70	48·21	54·24	...	...	...	...	...
75	45·0	50·62	56·25	...	...	...	...
80	42·18	47·46	52·73	58·0	...	...	...
85	39·70	44·67	49·63	54·59	...	...	...
90	37·50	42·18	46·87	51·56	56·25	...	...
95	35·52	39·96	44·40	48·84	53·29	57·73	...
100	33·75	37·96	42·18	46·40	50·62	54·84	...
105	32·14	36·16	40·17	44·29	48·21	52·23	56·25
110	30·68	34·51	38·35	42·18	46·02	49·85	53·69
115	29·34	33·01	36·68	40·35	44·02	47·69	51·35
120	28·12	31·64	35·16	38·68	42·18	45·70	49·21
125	26·93	30·30	33·66	37·03	40·40	43·76	47·13
130	25·96	29·20	32·45	35·69	38·94	42·18	45·43
135	25·0	28·12	31·25	34·37	37·50	40·62	43·75
140	24·10	27·12	30·13	33·14	36·16	39·17	42·18
145	23·27	26·18	29·09	32·0	34·91	37·82	40·73
150	22·50	25·31	28·12	30·93	33·75	36·56	39·37
155	21·77	24·49	27·21	29·94	32·66	35·38	38·10
160	21·09	23·73	26·36	29·0	31·64	34·27	36·91
165	20·45	23·01	25·56	28·12	30·68	33·23	35·79
170	19·85	22·33	24·81	27·29	29·78	32·26	34·74
175	19·28	21·69	24·10	26·51	28·92	31·34	33·75
180	18·75	21·10	23·44	25·79	28·13	30·48	32·82
185	18·24	20·52	22·80	25·08	27·36	29·64	31·92
190	17·76	19·98	22·20	24·42	26·64	28·86	31·08
195	17·30	19·47	21·63	23·79	25·96	28·12	30·28
200	16·87	18·98	21·09	23·20	25·31	27·42	29·53

* The diameter is that measured at the bottom of the corrugations outside.

FURNACES, MORISON'S SUSPENSION, CYLINDRICAL.

Steel Plates from $\frac{15}{32}$ inch to $1\frac{5}{8}$ inch thick.

Pressures and Diameters when *Machine* made.

Pressure per square inch.	Thicknesses and Diameters.*					
	15/32 in.	½ in.	17/32 in.	9/16 in.	19/32 in.	5/8 in.
	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.	Diameter in inches.
lbs. 60	...	...	...	...	...	...
65	...	...	...	...	...	...
70	...	...	...	...	...	...
75	...	...	...	...	...	...
80	...	...	...	...	...	...
85	...	...	...	...	...	...
90	...	...	...	...	...	...
95	...	...	...	...	...	...
100	...	...	...	...	...	...
105	...	...	...	...	...	...
110	57·52	...	...	...	...	...
115	55·02	58·69	...	...	...	...
120	52·73	56·25	...	...	...	...
125	50·50	53·86	57·23	...	...	...
130	48·67	51·92	55·16	58·41	...	...
135	46·87	50·0	53·12	56·25	...	..
140	45·20	48·21	51·22	54·24	57·25	...
145	43·64	46·55	49·46	52·37	55·28	58·19
150	42·18	45·0	47·81	50·62	53·43	56·25
155	40·82	43·54	46·27	48·99	51·71	54·43
160	39·55	42·18	44·82	47·46	50·09	52·73
165	38·35	40·90	43·46	46·02	48·57	51·13
170	37·22	39·70	42·18	44·67	47·15	49·63
175	36·16	38·57	40·98	43·39	45·80	48·21
180	35·17	37·51	39·86	42·20	44·55	46·89
185	34·20	36·48	38·76	41·04	43·32	45·60
190	33·30	35·52	37·74	39·96	42·18	44·40
195	32·45	34·61	36·77	38·94	41·10	43·27
200	31·64	33·75	35·86	37·96	40·07	42·18

* The diameter is that measured at the bottom of the corrugations outside.

EASING GEAR SHAFTS.

In the table immediately following, multipliers are given which will facilitate finding the size of easing gear shafts for safety valves from 2 inches to 6 inches diameter, with lifting forks up to 8 inches in length. See notes at the foot of the table.

The multipliers in the table are for two valves lifted by one shaft, but may be made applicable to three valves or one valve; they also may be made applicable to other pressures than given in the table. See the following notes:—

(*a*) When there are three valves lifted by one shaft and the screw lever is overhung, the number C opposite one and one half times the length of the lifting fork should be used *instead* of the number opposite the length of the lifting fork; if the exact half length is not found in the table, the nearest number C above may be used.

(*b*) When there is only one valve lifted by the shaft, the number C opposite *half* the length of the lifting fork should be used, *instead* of that opposite the length of lifting fork; if the exact *half* length is not found in the table, then the mean of the two C's opposite the nearest two half lengths should be used, or the nearest number C for the half length above may be used.

The pressures given in the table range from 40 lbs. advancing by multiples of 40 to 200 lbs. per square inch, but the table can easily be used for other pressures not enumerated; but when refinements of size are not necessary, it is, however, just as well when the pressure is between two of the pressures next each other in the table, say 160 lbs., and 200 lbs., to make the shaft equal to 200 lbs.

(*c*) When the pressure is not found in the table, but is, say $B_{\prime}$ and G is the diameter of a shaft for 40 lbs. pressure, then the diameter required for the new pressure $B_{\prime}$ is $= G \times \sqrt[3]{\frac{B_{\prime}}{40}}$.

(*d*) When triple valves are fitted, as is frequently the case, in order to keep down the size of valves, with the high pressures now in use, they are often fitted with a bell crank lifting lever to *each* valve, and the three cranks connected in tandem with a link; when gear of this description is fitted the pins or journals of the bell cranks need not exceed the diameter of the valve spindle.

Multipliers for finding the Diameters of Easing Shafts of Safety Valves * loaded at different pressures with Lifting Forks of different lengths.

Diameter of Valves.	40 lbs. Pressure per sq. in.	80 lbs. Pressure per sq. in.	120 lbs. Pressure per sq. in.	160 lbs. Pressure per sq. in.	200 lbs. Pressure per sq. in.
inches.	N	N	N	N	N
2	·5520	·6577	·7528	·8286	·8926
$2\frac{1}{4}$	·5646	·7114	·8143	·8693	·9655
$2\frac{1}{2}$	·6056	·7632	·8736	·9612	1·036
$2\frac{3}{4}$	·6455	·8133	·9309	1·025	1·104
3	·6840	·8618	·9865	1·086	1·170
$3\frac{1}{4}$	·7215	·9091	1·041	1·146	1·234
$3\frac{1}{2}$	·7581	·9551	1·094	1·204	1·297
$3\frac{3}{4}$	·7937	1·0	1·144	1·260	1·357
4	·8286	1·044	1·195	1·315	1·416
$4\frac{1}{4}$	·8626	1·086	1·244	1·369	1·475
$4\frac{1}{2}$	·8963	1·129	1·292	1·422	1·532
$4\frac{3}{4}$	·9291	1·170	1·339	1·475	1·588
5	·9615	1·212	1·387	1·527	1·644
$5\frac{1}{4}$	·9932	1·251	1·432	1·576	1·699
$5\frac{1}{2}$	1·025	1·291	1·478	1·626	1·752
$5\frac{3}{4}$	1·055	1·330	1·522	1·675	1·805
6	1·086	1·368	1·566	1·724	1·857

Length of Forks. L.	C	Length of Forks. L.	C.	Length of Forks. L.	C.	Length of Forks L.	C.	Length of Forks L.	C.
inches		inches		inches		inches		inches	
1	1·0	$2\frac{1}{2}$	1·357	4	1·587	$5\frac{1}{2}$	1·765	7	1·912
$1\frac{1}{8}$	1·040	$2\frac{5}{8}$	1·379	$4\frac{1}{8}$	1·603	$5\frac{5}{8}$	1·778	$7\frac{1}{8}$	1·924
$1\frac{1}{4}$	1·077	$2\frac{3}{4}$	1·401	$4\frac{1}{4}$	1·620	$5\frac{3}{4}$	1·791	$7\frac{1}{4}$	1·935
$1\frac{3}{8}$	1·122	$2\frac{7}{8}$	1·422	$4\frac{3}{8}$	1·635	$5\frac{7}{8}$	1·804	$7\frac{3}{8}$	1·946
$1\frac{1}{2}$	1·144	3	1·442	$4\frac{1}{2}$	1·650	6	1·817	$7\frac{1}{2}$	1·957
$1\frac{5}{8}$	1·175	$3\frac{1}{8}$	1·462	$4\frac{5}{8}$	1·666	$6\frac{1}{8}$	1·829	$7\frac{5}{8}$	1·968
$1\frac{3}{4}$	1·205	$3\frac{1}{4}$	1·481	$4\frac{3}{4}$	1·680	$6\frac{1}{4}$	1·842	$7\frac{3}{4}$	1·978
$1\frac{7}{8}$	1·233	$3\frac{3}{8}$	1·50	$4\frac{7}{8}$	1·695	$6\frac{3}{8}$	1·854	$7\frac{7}{8}$	1·989
2	1·260	$3\frac{1}{2}$	1·518	5	1·710	$6\frac{1}{2}$	1·866	8	2·0
$2\frac{1}{8}$	1·285	$3\frac{5}{8}$	1·536	$5\frac{1}{8}$	1·724	$6\frac{5}{8}$	1·878	..	..
$2\frac{1}{4}$	1·310	$3\frac{3}{4}$	1·553	$5\frac{1}{4}$	1·738	$6\frac{3}{4}$	1·889	..	..
$2\frac{3}{8}$	1·334	$3\frac{7}{8}$	1·570	$5\frac{3}{8}$	1·751	$6\frac{7}{8}$	1·901	..	..

When the screw lever of the shaft is overhung, that is outside the bearings, multiply the number N opposite the given diameter of valves and under the given pressure by the number C opposite the given length of lifting fork L; the product is the diameter of shaft required. When the exact length is not found in the Table, the nearest number C above may be used.

When the screw lever is placed on the shaft *between* the lifting forks, the number C opposite *half* the length of fork should be used, *instead* of that opposite the length of lifting forks; if the exact *half* length of lifting fork is *not* found in the Table, then the mean of the two C's opposite the nearest *two half* lengths should be used; or the nearest number C, for the half length above may be used.

* The Table is intended for cases where two valves are lifted by one shaft. When there are three valves, see note (*a*) in the previous page. When only one valve, see note (*b*).

When it is necessary to make shafts for pressures not given in the Table, see note (*c*) and paragraph preceding it.

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